THE NATIONAL

WASTE MANAGEMENT STRATEGY

FOR THE PERIOD 2010-2019

("Official Gazette of RS" no. 29/2010)

1. INTRODUCTION

Long-term strategy of Republic of Serbia in the area of environment protection shall mean the improvement of population's living quality by providing desirable conditions of environment and conservation of nature based on sustainable environment management. Key steps shall include strengthening of the existing and development of new measures for establishment of integrated waste management system, further integration of environmental policy into other sector policies, acceptance of extended individual responsibility for environment and more active participation of public in decision making processes.

The National Waste Management Strategy shall be a fundamental document providing requisites for rational and sustainable waste management at the Republic of Serbia level. The Strategy has to be supported by large number of implementation plans for management of specific waste streams (biodegradable, packaging and other). Establishment of economic instruments and financial mechanisms shall be necessary in order to provide for the system for national and international investments into long-term sustainable activities. Also, the Strategy shall consider needs for institutional strengthening, legislation development, regulations implementation at all levels, education and development of public awareness. Waste Management Strategy shall:

- establish basic orientation of waste management in the forthcoming period in accordance with the EU policy in this area and strategic determination of the Republic of Serbia;
- guide the activities of legislation harmonization in the process of the EU legislation approximation;
- identify responsibilities for waste and importance and role of ownership oriented capital;
- set waste management goals for short-term and long-term period;
- establish measures and activities for achievement of the set goals.

The following shall be needed to achieve goals of sustainable development, in accordance to the National Sustainable Development Strategy: rational raw material and energy use and use of alternative fuels from waste, reduction of danger from irregularly disposed waste to future generations, provision of stable financial resources and stimulating investment mechanisms, and implementation of activities in accordance with the "polluter pays" and/or "user pays" principles, establishment of a unified information system on waste, increase of inhabitants number covered by the municipal waste collection system, setting standards and capacities for waste treatment, reduction, re-

use and recycling, public awareness raising at all levels of the society about waste-related problems, etc.

It shall be necessary to create a sense of responsibility for waste handling at all levels, ensure problems recognition, provide correct and complete information, and promote principles, incentives and partnership between public and private sector in the area of waste management. Initiatives are aimed at stimulating the population to apply more responsible attitude towards waste and waste handling in a sustainable manner, such as reduction of waste at source, re-use of waste, recycling, waste energy use and waste disposal in a safe way.

Although the Republic of Serbia still has no obligation to implement goals set in the EU Directives related to comprehensive waste treatment, gradual inclusion of these requirements and establishment of waste management system shall be one of the priorities of the Republic of Serbia and all relevant strategic documents.

The National Strategy implementation assessment for period 2003-2008 has been done on the basis of analysis of planned priority activities and measures and current situation in waste management (Appendix 1). The assessment results show that implementation of the National Waste Management Strategy is not conducted by desirable dynamics despite significant measures undertaken in setting waste management system over the past years. Results have been achieved in the previous period in harmonization of regulations in the area of waste management by enacting the Law on Waste Management and Law on Packaging and Packaging Waste, although adoption of bylaws is yet to come. Results have also been achieved in institutional strengthening and development, association of municipalities into regions for waste management and signing of inter-municipality agreements. Efforts have also been made in the area of public awareness raising, because attitude on waste is slowly changing and understanding that waste is a resource is more and more present. Much of things have not been achieved in development of waste management financing system and application of economic instruments. Not much has also been achieved in the investment projects for waste management infrastructure building, except for the improvement in preparation of technical documentation. Waste dumps having been a risk to environment in some of municipalities have been rehabilitated.

1.1. Definition of expressions

***POPs* waste** – waste that is composed of, contains or is contaminated by persistent organic pollutants.

Packaging waste – any packaging or packaging material that cannot be used for the original purposes, except for the remains generated in the production process.

Anaerobic digestion – a process in which biodegradable material is decomposed in absence of oxygen.

Biodegradable waste – any waste that can be exposed to anaerobic or aerobic digestion, such as food or garden waste, paper and cardboard.

Construction and demolition waste – construction waste shall include: soil from earthworks, demolition waste and waste generated in construction (ceramics, concrete, iron, steel, plastic, etc.), as well as waste asphalt and concrete.

Landfill – site for surface or underground waste disposal where waste is disposed of, including: internal disposal sites (landfills used by a manufacturer for disposal of own waste generated on the spot), permanent sites (more than a year) used as temporary storage of waste, except for transfer stations and storage of waste before its treatment or re-use (less than three years), or storage of waste before disposal thereof (less than a year).

Permit – a decision made by competent authority which allows legal or private entity to collect, transport, import, export and transit, store, treat or dispose of waste, which also defines conditions for waste handling in the manner that poses the lowest risk to human health and environment.

EU Directives – legal instructions of the EU that relate all the member states and must be implemented through legislation of member states in prescribed deadlines.

Industrial waste – waste originating from any industry or site where industry is located, except for tailings and related mineral raw materials from mines and quarries.

Inert waste – waste that is not susceptible to any physical, chemical or biological changes; does not dissolve, burn or otherwise react in physical or chemical terms, is not biodegradable and does not affect adversely other materials when contacting such materials in the way that may result in environmental pollution or in threat to human health; leachate and contents of pollutants in waste and ecotoxicity of leachate shall be within allowed limits, and they particularly shall not affect quality of surface and/or ground waters.

Waste incineration (combustion) – thermal treatment of waste in stationary or mobile plant with or without use of energy generated in combustion, where primary role is thermal waste treatment.

Integrated waste management – includes numerous key elements partners in the decision-making process; application of various waste management options with local sustainable management system where each step in waste management process makes a part of the whole picture.

Used battery or accumulator – battery or accumulator that cannot be re-used and has become waste, intended for treatment, i.e. recycling.

Co-incineration (combined combustion) – thermal waste treatment in stationary or mobile plant primary role of which is energy recovery or production of material products, which uses waste as basic or additional fuel, or where waste is thermally treated before disposal.

Commercial waste – waste generated in companies, institutions and other organisations which are completely or partially in trade business, services, office activities, sport, recreation or entertainment, except for household and industrial waste.

Composting – biodegradable waste treatment under the action of microorganisms, aimed at generation of compost, in presence of oxygen and under controlled conditions.

Municipal waste – waste generated in households, as well as other waste which due to its nature and composition is similar to household waste.

Medical waste – heterogeneous mixture of municipal waste, infectious, pathoanatomic, pharmaceutical and laboratory waste, disinfectant and packaging, as well as chemical waste from healthcare institutions and veterinary institutions, in terms of this Strategy.

Non-hazardous waste – waste that does not have properties of hazardous waste.

Waste disposal – any process or method if there is no possibility to apply regeneration, recycling, recovery, direct re-use or use of alternative energy sources in compliance with D list (Law on Waste Management, Article 5).

Sustainable waste management – efficient use of material resources, reduction of generated waste quantities, and when generated, such waste is handled with in the manner that shall actively contribute to economic, social and ecological goals of sustainable development.

Hazardous waste – waste that according to its origin, composition or concentration of hazardous substances can result in danger to the environment and human health, and has at least one of hazardous properties (explosiveness, flammability, susceptibility to oxidation, it is organic peroxide, acute toxicity, infectious, susceptibility to corrosion, releases flammable gases in contact with air, releases toxic substances in contact with air or water, contains toxic substances with delayed chronicle effects, as well as ecotoxic properties), including containers which served or are serving as hazardous waste packaging.

Waste – any substance or item contained in the waste category list (Q List) rejected by the owner, or which is intended or has to be rejected by the owner, in compliance with law.

Waste of animal origins – waste generated in slaughterhouses, meat processing plants and facilities for animal breeding, as well as carcasses of dead animals.

Waste electric and electronic equipment – waste electric and electronic equipment and devices, as well as assemblies and components generated in industry.

End-of-life vehicles – motor vehicles or parts thereof which constitute waste, disposal of which is wanted by the owner, or the owner of such vehicles is unknown.

Waste oils – all mineral or synthetic oils or lubricants, which cannot be used for the original purpose, such as hydraulic oils, motor, turbine oils or other lubricants, marine oils, oils or liquids for insulation or heat transmission, as well as oil remains from tanks, oil-water mixture and emulsions.

Waste tyres – motor vehicle tyres (cars, buses, trucks, motorcycles, etc.), agricultural and construction machines, trailers, aircrafts, towed machines, other machines and devices and other similar products, upon the end of their life cycle, which are rejected by the owner or intended for rejection due to damages, wear and tear or other reasons.

Agricultural waste – waste generated in agricultural activities, forestry, food processing and wood industry.

Re-use – use of products that can be used more than once such as returnable packaging.

Specific waste streams – movement of waste (used batteries and accumulators, waste oil, waste tyres, waste electric and electronic equipment, end-of-life vehicles and other waste) from the source, via collection, transport and treatment, to landfilling.

Incineration plant – any stationary or mobile technical unit or equipment dedicated for thermal treatment of waste with or without recovery of heat generated in combustion process.

Plant for separation of recyclables – technological line for selection of useful recyclable components from the municipal waste.

Waste management facility – stationary technical unit for storage, treatment or disposal of waste, which makes technological unit together with the construction part.

Waste generator – commercial society, company or other legal entity, or entrepreneur, which activity results in waste generation and/or whose activity of pre-treatment, mixing or other processes results in changes in composition or nature of waste (Law on Waste Management, Article 5).

Waste management region – spatial unit which includes several local self-government units which, in accordance with the agreement entered into between those local self-government units, jointly manage waste so as to establish a sustainable waste management system.

Regional waste management centres – centres in waste management regions which contain: regional landfill, plant for separation of recyclables, transfer stations, composting facility, centres for collection of recyclable waste.

Waste reduction – priority action whose aim is to achieve maximal reduction of waste.

Recycling – recovery of waste materials in production process for the original or other purposes, except for energy purposes.

Waste collection – the activity of systematic collection of waste, classification, and/or mixing of waste for transport to further treatment or disposal.

Waste storing – temporary maintenance of waste at the manufacturer or waste owner's location, as well as operator's activities in a plant equipped and registered for temporary waste maintenance.

Transport of waste – transport of waste outside the facility, including loading, transport (as well as re-loading) and unloading of waste.

Transfer station – point to which waste is delivered and temporary stored for separation or re-load before transporting it to treatment or disposal.

Waste treatment – includes physical, thermal, chemical or biological processes, including waste separation, which change properties of waste, with the aim to reduce volume or hazardous properties, to facilitate handling with waste or encouraging recycling and it includes also re-use and recycling of waste.

Waste management – implementation of prescribed measures for handling with waste as a part of collection, transport, storing, treatment and disposal of waste, including supervision over those activities and care for waste management plant upon their closure (Law on Waste Management, Article 5).

Centre for separate collection of recyclable waste – the point designated by the local self-government units' decision, where citizens bring materials suitable for recycling, clumsy items (furniture, technical items), garden waste.

1.2. Waste types and classification

Waste shall be any substance or item rejected by the owner, is intending to reject it or has to do so. Types of waste are:

- Municipal waste (waste from households);
- Commercial waste;
- Industrial waste.

Municipal waste shall be waste from households, as well as any other waste which is similar to household waste due to its nature or composition.

Commercial waste shall be waste generated in commercial entities, companies, institutions and other organisations which are completely or partially in trade business, services, office activities, sport, recreation or entertainment, except for household and industrial waste.

Industrial waste shall be waste from any industrial location or site where industry is located, except for tailings and related mineral resources from mines and quarries.

Depending on the hazardous characteristics that affect human health and environment, waste can be:

- Non-hazardous;
- Inert;
- Hazardous.

Non-hazardous waste is waste that, due to its quantity, concentration or physical, chemical and biological nature, unlike hazardous waste, does not have adverse effects to human health and environment, and does not have properties of hazardous waste.

Inert waste is waste that is not susceptible to any physical, chemical or biological changes; does not dissolve, burn or otherwise react in physical or chemical terms, is not biodegradable and does not affect adversely other materials when contacting such materials in the way that may result in environmental pollution or in threat to human health; does not have any property of hazardous waste (acute or chronicle toxicity, infectious properties, carcinogenity, radioactivity, flammability, explosiveness); contents of pollutants in its water extract shall be within legally prescribed limits.

Hazardous waste is waste that according to its origin, composition or concentration of hazardous substances can result in danger to the environment and human health, and animal health, and has at least one of hazardous properties (explosiveness, flammability, susceptibility to oxidation, it is organic peroxide, acute toxicity, infectious, susceptibility to corrosion, releases flammable gases in contact with air, releases toxic substances in contact with air or water, contains toxic substances with delayed chronicle effects, as well as ecotoxic properties), including containers which served or are serving as hazardous waste packaging.

According to the Waste Catalogue, waste is classified into twenty groups depending on its source and origin. Waste Catalogue is used for classification of all types of waste, including hazardous waste, and it is fully harmonized with the EU Waste Catalogue, which is designed to create clear system of waste classification within the EU. The catalogue is the basis for all national and international reporting obligations related to waste, such as obligations related to waste management permitting, national databases on waste and waste transport. The Waste Catalogue is occasionally amended and updated.

Index no.	Source and origin of waste
01	Wastes generated in exploration, mining, quarrying, physical and chemical treatment of minerals
02	Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing
03	Wastes from wood processing and the production of panels and furniture, pulp, paper and cardboard
04	Wastes from the leather, fur and textile industries
05	Wastes from petroleum refining, natural gas treatment and pyrolysis treatment of coal
06	Wastes from inorganic chemical processes
07	Wastes from organic chemical processes
08	Wastes from the manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), sealants and printing inks
09	Wastes from photographic industry

10	Wastes from thermal processes
11	Wastes from chemical surface treatment and coating of metals and other materials; non-ferrous hydro-metallurgy
12	Wastes from shaping and physical and mechanical surface treatment of metals and plastics
13	Oil wastes and wastes of liquid fuels (except edible oils, 05, 12 and 19)
14	Waste organic solvents, refrigerants and propellants (except 07 and 08)
15	Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified
16	Wastes not otherwise specified in the list
17	Construction and demolition wastes (including excavated soil from contaminated sites)
18	Wastes from human or animal health care and/or related research (except kitchen and restaurant wastes not arising from immediate health care)
19	Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use
20	Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions

1.3. The EU policy in the area of waste management

A Thematic Strategy on the prevention and recycling of waste, known as the Thematic EU Strategy on Waste, is aimed at prevention of waste generation, as well as use of waste as resource mainly as secondary raw materials and energy. On the other hand, there is a warning that internal market has to facilitate recycling and re-use activities, setting high standards for the environment. As a prerequisite for the achievement of the mentioned goals, it is necessary to modernise the existing regulatory framework reflected through introduction of life cycle analysis into management policy and simplification and clarification of EU waste legislation.

Within EU regulatory and planning documents, reduction of waste generation is promoted more and more, which would reduce waste problem at its very source. There is, however, a significant difference in implementation of this principle in the EU member states. Percentage of waste recycling ranges between 10 and 65%, and percentage of waste disposal at waste dumps ranges between 10% and 90%. Principle of reduction of waste quantities includes the initiatives for introduction of cleaner technology, and comprehensive campaigns for public awareness raising among population, in schools, etc. The EU waste policy outlines the development of measures such as:

- promotion of cleaner production;
- removal of hazardous characteristics of waste through treatment;
- setting technical standards limiting content of certain hazardous substances in products;
- promotion of waste re-use and recycling;
- application of economic instruments;
- analysis of product life cycle;
- development of eco-label scheme.

Implementation of environment policy shall be based on the precautionary and prevention principles; namely, each activity has to be planned and implemented in a way to cause smallest possible change in the environment and to pose smallest possible risk to the environment and human health, to reduce spatial overload and consumption of raw materials and energy in construction, production, distribution and use.

Principles of waste management common to all EU directives in this field are relevant in the process of waste management planning:

- The prevention principle – provide for nature and natural resources conservation through reduction of waste generated.
- The precautionary principle – provide for reduction of waste impact to human health and environment, as well decrease of dangerous substances amounts in waste.
- The "polluter pays" principle – ensure that waste generators and environment polluters bear costs and responsibility for their actions.
- The vicinity principle – provide for the appropriate infrastructure through the establishment of integrated and adequate system and network of facilities for waste treatment and disposal based on the principle of vicinity and care for own waste.

1.4. Links to other strategic documents

The Government adopted the **National Program of Integration (NPI)** in October 2008, which is a basis of legislative work plan of the Government till 2012, which the Strategy on the EU Accession of Serbia marked as the year when Serbia is ready to take over obligations emanating from the EU membership. NPI is a precise plan to achieve all criteria necessary for a state to become member of EU, from political to economic, up to adoption of laws and most detailed standards existing in the Union, in areas such as, *inter alia*, trade, agriculture, environment protection, infrastructure. The aim of the NPI is to provide state authorities with a framework to monitor their own progress in the EU accession process, clearly and in a measurable manner. There is a specific chapter related to schedule of regulations adoption and development of institutional capacities and needs in the area of waste management.

The National Sustainable Development Strategy (Official Gazette of RS, no. 57/08) was adopted by the Government in May 2008. The aim of the Republic of Serbia Sustainable Development Strategy is to balance three pillars, three key dimensions – economic growth, environment protection and social balance creating one coherent entity supported by corresponding institutional framework. This Strategy significantly contributes to elimination of gaps between policy making processes, harmonization of possible conflict objectives in the policies, as well as to identification of their mutual advantages. This means integration and harmonization of goals and measures of all sectorial policies, harmonization of national regulations with the EU legislation and their full implementation. It also includes objectives of waste generation reduction and development of infrastructure for waste management, enactment of regulations and regional and local waste management plans. In March 2009, the Government adopted also the Action Plan for implementation of National Sustainable Development Strategy.

The Strategy of Energy Development in the Republic of Serbia by 2015 (Official Gazette of RS, no. 44/05) and Regulation on the establishment of a Programme for implementation of the Strategy of Energy Development of the Republic of Serbia by 2015 in the period 2007-2012 (Official Gazette of RS, no. 17/07, 73/07 and 99/09) define energy development priorities. As a part of third – specific priority, which includes the Programmes for selective use of new renewable energy sources and Programmes of new more energy efficient and environmentally friendly technologies, use of waste for energy recovery is particularly considered.

The Regional Development Strategy of the Republic of Serbia for period 2007-2012 (Official Gazette of RS, no. 21/07) was adopted in January 2007. This document treats regional development in Serbia, for the first time in a comprehensive and consistent manner – all created problems and disparities – and suggests a series of measures for their mitigation and solution. Enactment of the Law on Regional Development is one of the first steps in Strategy implementation. Differences in the degree of development in Republic of Serbia and territorial parts are highest ones in Europe and they show growing trend each year. According to the development endangerment index, the proportion between the most developed district and the least developed one is 1:7.

Strategy of Cleaner Production Introduction (Official Gazette of RS, no 17/09) was adopted by the Government in March 2009, and it is the elaboration of strategic documents, especially of the National Sustainable Development Strategy and National Environmental Protection Programme. The Strategy segments the concept of sustainable development through stimulation of application of cleaner production.

The Decision on the Establishment of the National Environmental Protection Programme (Official Gazette of RS, no. 12/10) defines strategic objectives of the environmental protection policy, as well specific objectives for protection of environmental media (air, water, soil) and influence of certain sectors on environment (industry, energy, agriculture, mining, traffic, etc.) It also identifies priority objectives within media and sectors and suggests their reforms in order to achieve all changes necessary for objectives implementation. The proposed reforms encompass reforms of regulatory instruments, economic instruments, monitoring systems and information systems, financing system in the area of environmental protection, institutional issues and requirements related to infrastructure in the area of environmental protection. Although the document has not been officially adopted yet, it is a comprehensive one and it created the basis for other strategies adopted in the meantime.

The Spatial Plan of the Republic of Serbia is in preparatory phase. The Spatial Plan of the Republic of Serbia shall be a framework for definition of a new approach in spatial planning management, i.e. in monitoring and guiding of phenomena and processes in space, and shall establish basic guidelines for the development by setting long-term objectives instrumentalities and defining priority and strategic projects and implementation activities. The chapter on waste management defines infrastructure for waste management in the spatial planning, which is very important for a comprehensive spatial planning.

Acronyms used in the text

BAT – Best Available Technology

BEP – Best Environmental Practice

GNP – Gross National Product

DDT – Dichlorodiphenyltrichloroethane

EBRD – European Bank for Reconstruction and Development

EEA – European Environmental Protection Agency

EIA – Environmental Impact Assessment

EIONET – European Information and Observation Network

EMAS – Eco-Management and Audit Scheme

EU – European Union

IPPC – Integrated Pollution Prevention and Control

NIP – National Investment Plan

PET – Polyethylene Terephthalate

PCB – Polychlorinated Biphenyls

POPs – Persistent Organic Pollutants

SIDA – Swedish International Development Cooperation Agency

SWOT – Strength, Weaknesses, Opportunities and Threats Analysis

toe – Ton Oil Equivalent

Fund – Environmental Protection Fund

2. LEGAL FRAMEWORK FOR WASTE MANAGEMENT

2.1. National legislation in the area of waste management

New legal framework for waste management was established by the enforcement of a set of laws in the area of environmental protection (2004), including new laws which regulate waste, i.e. packaging and packaging waste management (2009). These laws provide conditions for establishment and development of integral waste, i.e. packaging and packaging waste, management system. Basic regulations which govern waste management in the Republic of Serbia are the following:

1) **Law on Ratification of the Basel Convention on Transboundary Movement of Hazardous Waste and its Disposal** (Official Gazette of FRY, International Agreements, no. 2/99) provides internationally aligned mechanisms and instruments for the control of transboundary movement of waste;

2) **Law on Environmental Protection** (Official Gazette of the Republic of Serbia, no. 135/04 and 36/09) sets forth the integrated system of environmental protection comprising action plans, conditions and instruments for sustainable management and conservation of natural balance, integrity, diversity and quality of natural values and conditions for survival of living beings, prevention, control, reduction and rehabilitation of all forms of pollution, promotion and utilization of products, processes, technologies and practices which have less harmful effect on environment, application of special codes of conduct in waste management from its generation point to its disposal, i.e. prevention or reduction of its generation, waste reuse and recycling, separation of secondary raw materials and utilization of waste as fuel, waste import, export and transit, establishment of Environmental Protection Agency and Fund, staff training designed to upgrade knowledge and raise awareness, information access and participation of the public in decision making process. Based on the Law on Environmental Protection, the following have been adopted:

- Rulebook on the documentation to be submitted along with the permit application for import, export and transit of waste (Official Gazette of RS, no 60/09).

Based on this Law, several regulations have been adopted, including a regulation that pertains to the conditions to be fulfilled by professional organisations for waste testing in terms of human resources, equipment, premises and other conditions required for testing:

- Rulebook on the conditions to be fulfilled by professional organisations for waste testing (Official Gazette of RS, no. 53/06).

Also, based on the Constitution of the Republic of Serbia, Law on Government, related to Law on Environmental Protection (Official Gazette of RS, no. 135/04), the following regulations have been adopted to regulate specific waste streams management:

- Regulation on waste oils management (Official Gazette of RS, no. 60/08 i 8/10);
- Regulation on the manner and procedures for asbestos-containing waste management (Official Gazette of RS, no. 60/08).

3) **Law on Strategic Environmental Impact Assessment** (Official Gazette of RS, no. 135/04) sets forth the relations between environmental protection policy and other departmental policies, which are currently being developed**,** as well as the development of new plans and programmes in the field of spatial and urban planning or land use, agriculture, forestry, fisheries, hunting, energy, industry, transport, waste management, water management, telecommunications, tourism, natural habitat and wild flora and fauna conservation, establishing a framework for adoption of future development projects. Furthermore, it regulates conditions, method and procedures of conducting the strategic assessment of environmental impact of certain plans and programmes within their preparation and adoption phases, as well as the content of reports to be made on strategic assessment, its verification and public involvement, i.e. participation in the report evaluation proceedings. This law conforms to the corresponding EU Directive.
4) **Law on Environmental Impact Assessment** (Official Gazette of the RS, no. 135/04 and 36/09) sets forth the procedure with regard to the assessment of potentially significant environmental impacts of certain projects carried out by public or private enterprises, the content of study on environmental impact assessment, the liability of applicants for permits or approvals for development or reconstruction of buildings, the change of technologies, the capacity expansion, the discontinuation of operations and cancellation of projects which may have an important environmental impact or other interventions taking place in nature and natural environment, as well as participation of the public in project development or approval. The impact assessments is carried out in the case of projects in the field of industry, mining, energy, traffic, tourism, agriculture, forestry, water management, waste management and public utility services, as well as in the case of projects planned in protected areas or protected surroundings of immovable cultural good.
5) Law on Integrated Pollution Prevention and Control (Official Gazette of RS, no. 135/04) sets forth conditions and procedure for issuance of integrated operating permit for plants and activities which may have negative impact on human health, environment or tangible assets, type of activities and plants, supervision and other relevant aspects of environmental pollution prevention or control. Since no integrated permit has yet been issued in the Republic of Serbia, the first deadline to file for it is set for the industry of minerals (December 2009 – September 2010), followed by other industrial branches such as food industry, treatment of animal carcasses and animal waste, disposal and management facilities, pig and poultry breeding farms, pulp, wood, paper and cardboard production, leather tanning and similar activities (October 2010 – September 2011), metal production and processing (October 2011 – March 2012), chemical industry (April 2012 – December 2012), production of energy and waste management (January 2013 – December 2013) and the industry of minerals – production of asbestos and asbestos-based products (January 2014 – March 2014). On the basis of the aforesaid Law, the following Regulation has been adopted:

   - Regulation on the establishment of schedule programme for applying for IPPC permit (Official Gazette of RS, no.108/08) prescribes, *inter alia*, that an operator in charge of animal carcasses and animal waste disposal in a recycling facility of a capacity exceeding 10t/day shall apply for an integrated permit in the period from October 2010 to March 2011, whereas an operator in charge of waste management (disposal or reuse of hazardous waste) in a facility of a capacity exceeding 10t/day, municipal waste incineration facilities of a capacity exceeding 3t/day, non-hazardous waste storing facilities of a

capacity exceeding 50 t/day and landfills storing more than 10 t/day or of an overall capacity exceeding 25,000 t, excluding inert waste landfills, shall apply for an integrated permit in the period from January 2013 to December 2013.

6) **Law on Waste Management (**Official Gazette of the RS, no. 36/09) sets forth types of waste and its classification, waste management planning, stakeholders, obligations and liability with regard to waste management, specific waste streams management, requirements and procedures for the issuance of permits, transboundary waste movement, reporting, waste management financing, supervision and other relevant aspects of waste management. Waste management consists of a set of activities of joint interest which comprise implementation of prescribed action plans to be carried out within waste collection, transport, storing, treatment and disposal, including supervision of the aforesaid activities and responsibility for waste management facilities upon closure thereof.

Law on Waste Management prescribes deadlines for the harmonization of business operations of legal and private entities with the provisions under the Law, specifically: (1) waste generators operating in existing facilities, which are to obtain integrated permits in accordance with the specific law, shall, within a year from the day the Law comes into force, develop a waste management plan for the facility, comprising a special action plan and the dynamics of harmonization of present facility processes and activities with the provisions under the Law by 31st December 2015, whereas in the event the facility served as a temporary waste storage, the waste generator shall provide removal of the temporary stored waste within three years from the day the Law comes into force, at latest; (2) operators of the existing facilities in charge of waste management, i.e. legal or private entities dealing in the field of waste management, shall, within six months from the day the Law comes into force, report its business to the permitting authority, in accordance with the Law, and shall develop an action plan to stipulate dynamics of harmonization of present facility processes with provisions under the law by 31st December 2012; (3) local self-government unit shall: conduct inventory of unregulated disposal sites in its area which do not adhere to the stipulated provisions within a year from the day the Law comes into force; develop a rehabilitation and re-cultivation programme to be implemented on unregulated disposal sites within two years from the day the law comes into force; determine a location for construction and operation of a facility for waste storing, treatment or disposal in its area in collaboration with one or more local self-government units within a year from the day the Law comes into force; (4) producers and importers of electrical and electronic products shall align their electrical and electronic waste management with this Law by 31st December 2012; (5) disposal, i.e. decontamination, of devices containing PCB and disposal of PCB from the devices shall be conducted no later than 2015, whereas other obligations shall be prescribed by a specific regulation.

Upon enforcing this Law, the preceding Law on Handling with Hazardous Substances ceased to be valid (Official Gazette of RS, no. 25/96, 26/96 and 101/05), with an exception of the following Rulebook which shall be applied until new bylaws take effect:

- Rulebook on conditions and methods of sorting, packing and storing of secondary raw materials (Official Gazette of RS, no. 55/01) which in detail sets forth conditions and method of sorting, packing and preservation of

waste – secondary raw materials which may be used after treatment, i.e. processing, and which originate from technological production processes, recycling, processing or regeneration of waste substances, services, consumption or other activities. Waste Catalogue and Waste Lists aligned with the EU regulations have been printed and attached to the subject Rulebook.

Furthermore, until new bylaws are adopted on the basis of the Law on Waste Management, regulations passed on the basis of the priory valid Law on Environmental Protection shall be applied (Official Gazette of RS, no. 66/91, 83/92, 53/93-other law, 67/93- other law, 48/94- other law, 53/95 and 135/04):

- Rulebook on criteria for determination of location and development of landfills for hazardous substances (Official Gazette of RS, no. 54/92) which sets forth the criteria for determination of location of hazardous substance landfills, method of sanitary and technical development of landfills for environmental protection, as well as the method of landfill closure;
- Rulebook on management of waste having properties of hazardous substances (Official Gazette of RS, no. 12/95) sets forth the method of managing of certain types of waste having hazardous properties, conducting inventory of types and quantities of hazardous substances in production, use, transport, marketing, storing and disposal and provides waste categorization in accordance with the Basel Convention;
- Rulebook on methodology for risk assessment related to chemical accident and environmental pollution, action plans for preparation and rehabilitation of consequences (Official Gazette of RS, no. 60/94).

On the basis of the Constitution of the Republic of Serbia and with reference to the Law on Environmental Protection of 1991, the following Regulation has been adopted and applied:

- Regulation on transport of hazardous substances by roads and railways (Official Gazette of RS, no. 53/02) closely prescribes the conditions and method of transporting of hazardous substances by roads and railways;

7) **Law on Packaging and Packaging Waste Management** (Official Gazette of RS, no. 36/09) sets forth environmental requirements which packaging must meet in order to be marketed; packaging and packaging waste management, reporting on packaging and packaging waste, economic instruments, as well as other relevant issues with regard to packaging and packaging waste management. The Law also regulates imported packaging, produced, i.e. marketed packaging, as well as packaging waste generated in the course of business activities on the territory of the Republic of Serbia, regardless of its origin or purpose, and used packaging material.

   Law on Packaging and Packaging Waste Management prescribes deadlines of twelve to eighteen months for the period of harmonization of (1) producers, importers, packaging/bottling plants and delivery companies in terms of: organization of overtaking of packaging waste and providing of space for collection, sorting and temporary storing of packaging waste; entrance into agreement with the operator in charge of municipal packaging waste and

packaging waste which is not categorized as municipal, or obtaining of permit to independently manage packaging waste; establishment of packaging waste management; labelling marketed packaging with information on the possibility to leave packaging waste immediately on the point of purchase or return it free-of-charge later on; (2) end users who import or purchase packaging or raw materials for production of packaging for the purpose of their own businesses, and who do not cooperate with a supplier, and who must provide an adequate management of packaging waste which cannot be categorized as municipal, by way of concluding an agreement with an operator or relying on its own resources to provide re-use, recycling or disposal of packaging waste. The postponement of the law enforcement is stipulated for (1) producers and importers of packaging who shall align their business operations with regard to labelling of packaging within twelve months from the day the new Law comes into force; (2) packaging which was produced prior to the day the Law came into force, and is not compliant with basic prerequisites for marketing, may be on the market no longer than two years from the day the Law comes into force.

Other regulations relevant for waste management are stipulated in Appendix 2.

2.2. EU legislation in the area of waste management

Council Directive 2008/98/EC on waste, superseding and amending Framework 75/442/EEC Directive, 2006/12/EC establishes a system for coordinated waste management in the EU aiming to restrict waste production. Under the Framework Directive on Waste, member states are obliged to develop a waste management plan. The new 2008/98/EC General Directive on Waste contains the following definitions (different from those stated in 2006/12/EC Directive):

- new terms are introduced: bio waste, waste oil, dealer, collection, separate collection, treatment, the best available techniques (BAT), etc.;
- set recycling and utilization goals remained the same – 50% of total amount of collected municipal waste and 70% of remaining non-hazardous waste by 2020;
- waste utilization for the purpose of energy generation is not specially defined in general requirements of the Directive, but is stated in Annex 2 – in the list of potential utilization activities;
- adherence to the principle of hierarchy in waste management;
- Annex 1 of the Directive stipulates the acceptable methods of disposal;
- prescribes certain minimum standards which must be met in the course of application of different methods of waste treatment.

Council Directive 99/31/EC on landfills aims to introduce strict technical requirements in order to reduce negative impact of waste disposal on environment, especially land, ground and surface waters, as well as human health. The Directive defines different waste categories (hazardous, non-hazardous and inert); landfill classes: hazardous waste landfill, non-hazardous waste landfill and inert waste landfill; requires treatment prior to disposal; bans landfill disposal of: liquid waste, flammable or highly flammable waste, explosive waste, infectious medical waste, old tires and other types of waste; prescribes reduction of biodegradable waste disposal and establishes a system of landfill permitting.

Council Directive 2000/76/EC on Waste Incineration supersedes**:**

- 84/429/EC Directive on Reduction of Air Pollution originating from the existing municipal facilities for waste incinerations;
- 89/369/EC Directive on Reduction of Air Pollution originating from new municipal facilities for waste incinerations;
- 94/67/EC Directive on Hazardous Waste Incineration.

The Directive aims to set standards for reduction of air, water and land pollution originating from waste incineration or co-incineration, in order to reduce risks to human health. Hazardous waste incineration may cause emission of substances which pollute air, water and land and which have negative impact on human health. The Directive also refers to co-incineration facilities.

Council Directive 2006/66/EC supersedes and supplements the 91/157/EEC Directive on batteries and accumulators containing hazardous substances introduces measures for disposal and control of disposal of used batteries and accumulators containing hazardous substances in order to reduce pollution with heavy metals used in production of batteries and accumulators.

Council Directive 75/439/EEC on waste oils disposal supplemented with Directives 1987/101/EEC, 91/692/EEC, 2000/76/EC promotes collection and disposal of mineral lubricants or industrial waste oils that cannot be used for original purposes. The Directive: prohibits handling with waste oils which causes air pollution above the prescribed limit values; requires provision of a safe and efficient system for collection, treatment, storing and disposal of waste oils; highest priority is given to waste oil regeneration, followed by incineration with energy recovery, while lowest priority is given to destruction or controlled storing; discharge of waste oils into surface or ground waters and sewage, as well as on the ground, shall be prohibited.

Council Directive 91/689/EEC on hazardous waste supplemented by Directives 94/31/EC and 166/2006/EC is aimed at the establishment of management, utilisation and proper disposal of hazardous waste. The Directive defines that commercial entities which generate, store or remove hazardous wastes, shall submit to the competent authority, at their request, the required register data.

Council Directive 96/59/EC on PCB and PCT is aimed at defining a controlled way to handle and eliminate polychlorinated biphenyls (PCB) and polychlorinated terphenyls (PCT) and to decontaminate equipment that contained them, as well as to dispose of all PCB-contaminated equipment, where decontamination has not been applied.

Council Directive 2000/53/EC on end-of-life vehicles establishes measures for prevention of waste generation by stimulating collection, re-use and recycling of components (batteries, tyres, accumulator, oil) in order to protect the environment.

Directive 2002/95/EC on restrictions in use of certain hazardous substances in electric and electronic equipment and Directive 2002/96/EC on waste electric and electronic equipment are aimed at restriction in use of certain hazardous substances in electric and electronic equipment, i.e. promotion of re-use, recycling and use of electric and electronic equipment in order to reduce waste quantity. The EU laws introduce

restrictions in use of hazardous substances in production of electric and electronic equipment in order to facilitate recycling. Member states have to establish a collection system whereat owners and distributers of electric and electronic equipment may take such equipment from households back free of charge. It has been prescribed that starting from 1 January 2008 lead, mercury, cadmium, six valent chromium, polybrominated biphenyls and polybrominated diphenyls in electric and electronic equipment shall be replaced by other materials.

Directive 86/278/EEC on environmental protection and soil in particular in case of use of secondary fertilisers in agriculture defines the use of sludge from wastewater treatment plants in agriculture in order to prevent pollution of soil, vegetation, humans and animals. Sludge from municipal WWTP has favourable characteristics and can be used in agriculture. However, heavy metals contained in the sludge may be toxic for plants. The Directive: defines the notion of sludge, treated sludge, prescribes conditions under which sludge can be used, sets limit values for heavy metals concentrations in soil and sludge, as well as maximal quantity of heavy metals in soil allowed at annual level, and so on.

Regulation 1774/2002 on animal waste prescribes technological processes for animal waste treatment. Animal waste has been classified into three categories. Category 1 shall include carcasses infected by BSE (Bovine spongiform encephalopathy, mad-cow disease), other dangerous zoonosis, as well as other unknown risk related to animal treatment by illegal substances. Category 2 shall include remains of ill animals or remains of veterinary medications. Category 3 shall include remains of dead healthy animals, animal parts from slaughterhouses that are not used for commercial purposes, hide, degreased bones, blood (except for ruminants), and so on.

Regulation 1013/2006 on transboundary movement of waste regulates supervision and control of transboundary movement of waste. It introduces provisions of the Basel Convention into the European legislation. The Basel Convention is an international multilateral agreement which regulates norms of handling, criteria for waste management in the manner that is harmonised with environmental protection and development requirements, and procedures in transboundary movement of hazardous and other wastes. Countries that apply this Regulation shall designate adequate authorised organisations for waste transport. The Directive shall establish:

- Labelling and notification system, as well as obligations related to contracting and subcontracting in different operations in waste transport;
- Manner of authorisation of the persons concerned in the procedure;
- Manner and conditions of dispatch, transport and reception;
- Import of waste into third countries;
- Obligation to return waste and disposes of it in environmentally favourable manner if the dispatch procedure cannot be successfully completed;
- Member states shall make necessary steps to inspect, sample and monitor waste in transboundary movement.

Directive 78/176/EEC on waste generated in titanium dioxide industry, supplemented by Directives 82/883/EEC (further supplemented by Regulation 807/2003/EC), 83/29/EEC and 91/692/EEC (further supplemented by Regulation 1882/2003/EC) pertains to prevention and progressive phasing out of pollution caused

by waste generated in titanium dioxide industry. Member states shall take necessary steps to ensure that waste disposal in carried out with care taken for human health and environment. They will actively support prevention of waste generation, re-use and recycling of waste as raw material. Any release, disposal, piling or injecting of waste shall require prior permitting, member states shall develop programmes for phasing out of pollution and final removal of pollution caused by waste generated in plants for production of titanium dioxide.

Council Directive 94/62/EC on packaging and packaging waste supplemented by Directive 2005/20/EC, 2004/12/EC, 1882/2003/EC implements the EU strategy on packaging waste and is aimed at harmonisation of national measures for packaging waste, minimise packaging waste environmental impacts and avoid trade barriers in the EU which may prevent competition. It treats all packaging placed on the EU market, regardless its origins: industry, commercial sector, retails, services, households, taking into account the materials used.

Commission Decision 2001/524/EC on published standard references EN 13428:2000, EN 13429:2000, EN 13430:2000, EN 13431:2000 and EN 13432:2000 in the Official Gazette of the European Community related to the European Parliament and Council Directive 94/62/EC on packaging and packaging waste.

Commission Decision 2001/171/EC dated 19 February 2001 on conditions for reduction of heavy metals concentration in glass packaging established by the European Parliament and Council Directive 94/62/EC on packaging and packaging waste.

Commission Decision 2005/270/EC dated 22 March 2005 on the establishment of template that pertains to databases from the European Parliament and Council Directive 94/62/EC on packaging and packaging waste.

Commission Decision 1999/177/EC on conditions for reduction of heavy metals concentration in plastic crates and palettes established by the European Parliament and Council Directive 94/62/EC on packaging and packaging waste.

3. INSTITUTIONAL FRAMEWORK

The National Assembly and the Government of the Republic of Serbia are providing the legal framework for sustainable waste management, economic instruments for waste management implementation and they influence the development of public awareness and setting-up of a dialogue between the interested parties, aiming to set-up a waste management partnership.

Competent authorities and organizations responsible for waste management are as follows:

- Ministry in charge of the environmental protection and other competent ministries;
- Competent authority of the autonomous province;
- Competent authority of the local self-government unit;

- Environmental Protection Agency (hereinafter referred to as: Agency);
- Environmental Protection Fund (hereinafter referred to as: Fund);
- Professional waste testing organizations.

The Ministry shall:

- propose Waste Management Strategy and individual national plans for managing of various waste streams to the Government;
- prepare and enact executive regulations for implementation of laws;
- coordinate and perform waste management activities that are significant for the Republic and monitors the condition;
- approve regional waste management plans, except for plans on the territory of the autonomous province;
- issue permits, approvals, confirmations and other documents defined under the law;
- maintain records on permits, approvals, confirmations and other documents issued by other competent authorities;
- designate the authorized organizations pursuant to the law;
- monitor and control the implementation of measures for handling with waste;
- undertake other measures and activities pursuant to the international contracts and agreements.

In the area of packaging and packaging waste management, the Ministry shall:

- prepare and propose Packaging Waste Reduction Plan to the Government;
- prepare and enact executive regulations for implementation of law;
- issue and withdraw permits for packaging waste management pursuant to the law;
- set up and maintain a register of permits issued for packaging waste management;
- determine the level of deposit fee for the packaging depending on the type of packaging or the chemical stored in the packaging;
- monitors the operation of the Agency, autonomous province, local self-government unit, as well as authorized legal entities, in implementation of the entrusted activities.

Ministry of Agriculture, Forestry and Water Management shall perform the activities in relation to management, protection and use of agricultural land for exploitation of mineral raw materials and disposal of tailings, ashes and other waste and slag and other waste and hazardous substances, recultivation of agricultural land, protection of waters and plants, and animal health protection, including management of agricultural waste, animal waste, wastewaters and sewage systems, inspection activities, as follows:

- **Veterinary Directorate** shall perform the activities in relation to: protection and improvement of animal health and welfare, determination of infectious diseases and measures for prevention of the occurrence thereof, detection, prevention of spreading, suppression and eradication of animal infectious diseases that can be transferred to humans, veterinary-sanitary control and conditions for production and trade in animals, products of animal origin, food of animal origin, fodder, as well as conditions for veterinary activities, control that pertains to production and trade in medications intended for use in veterinary medicine, veterinary medical

products and ancillary medications, including waste management generated in facilities for animal healthcare and pharmaceutical waste management, etc.
- **Plant Protection Directorate** shall perform the activities in relation to: protection of plants from contagious diseases and pests, control of plant protection products and fertilizers during the production, domestic and international trade, control of plant protection products application, etc.
- **Republic Water Directorate** shall perform the activities in relation to: water supply, protection against waters, water protection etc.

Ministry of Health shall perform the activities related to manufacturing and trade in drugs, medical items and ancillary medications, including management of waste from the health care facilities and management of pharmaceutical waste, sanitary monitoring etc.

Ministry of Mining and Energy shall perform the activities related to management of waste generated in exploitation of mineral raw materials.

Competent Authority of the autonomous province shall**:**

- participate in preparation of Waste Management Strategy and individual national waste management plans;
- adopt Waste Management Plan for certain waste types of importance for the autonomous province in compliance with the Strategy and National Plan;
- coordinate and perform the activities of waste management that are significant for the autonomous province and monitor the condition;
- approve regional waste management plans on its territory;
- issue permits, approvals, confirmations and other documents defined under the law, maintain records and submit data to the Ministry;
- monitor and control the implementation of measures for handling with waste on its territory;
- perform other activities set forth under the law.

Competent authority of local self-government unit shall**:**
- adopt local waste management plan, provide the conditions and take care of its implementation;
- regulate, provide for, organise and implement management of municipal i.e. inert and non-hazardous waste on its territory;
- regulate the procedure for charging of services in the field of waste, i.e. inert and non-hazardous waste management;
- issue permits, approvals and other documents pursuant to the law, maintain records and submit data to the Ministry;
- upon the request by the Ministry or the competent authority of autonomous province, provide the opinion in permitting procedure;
- monitor and control the implementation of measures for handling with waste pursuant to the law, and other activities set forth under the law.

Two or more local self-government units enact waste management plan defining the joint objectives in waste management. Preparation and enacting of the regional waste management plan is governed by the agreement of the local self-government units assemblies. Regional waste management plan is approved by the Ministry, i.e. by the competent authority of the autonomous province on its territory.

The Fund shall perform the activities in relation to funding of preparation for implementation and development of programmes, projects and other activities in the field of conservation, sustainable utilization, protection and enhancement of the environment and use of renewable energy sources. The Fund shall finance action and rehabilitation plans, i.e. programmes, projects and other investment and operational activities in the field of waste management, particularly the following ones: construction of waste management facilities; rehabilitation of dumpsites; rehabilitation of hazardous waste disposal sites; enhancement of waste management organisation; management of specific waste streams; introduction of separate waste collection; reduction of waste generation and using of valuable waste properties; stimulation of treatment capacities development; stimulation of recycled materials market. The Fund shall also finance preparation and implementation of regional waste management plans, development of IT system for waste management; assist in development and implementation of new waste treatment technologies; provide additional sources of funding; support and implement other activities that are necessary in the process of enhancing the waste management system.

The Agency shall maintain and update the database on waste management in the environmental protection IT system pursuant to the law governing the environmental protection. Within the specific waste streams, the Agency shall collect data from the entities that perform collection, storing and treatment of all waste categories from this group pursuant to the law. From the viewpoint of municipal waste management monitoring and implementation of regional or local plans, the Agency shall collect data on the implementation of the above plans. Moreover, the Agency shall collect data from the registers of issued permits, which are set up and maintained by the authorities in charge of permitting that submit the data from the register to the Agency. The Agency shall collect the reports on packaging and packaging waste management from manufacturers, importers, companies that deal with packaging and filling, and suppliers, operators and other manufacturers, importers, packaging and filling companies and suppliers on the quantities and types of packaging and packaging waste and shall establish and maintain a register on quantities and types of packaging and packaging waste. Based on these data, the Agency shall compile and publish the annual report on the quantity of manufactured, imported and exported packaging and packaging waste management by the Agency.

Professional waste testing organizations shall perform testing of waste for classification purposes with respect to transboundary movement of waste, treatment and disposal, in accordance with the testing volume they are certified for, and shall issue a report on waste testing.

Other participants in waste management shall be product manufacturers or importers of products that become waste upon their use, waste owners, waste generators, waste transporters, as well as operators of facilities for waste collection, waste treatment, and landfill operators.

4. BRIEF OVERVIEW AND ANALYSIS OF CURRENT WASTE MANAGEMENT STATE

Waste generation results from the overall economic activity of every country, and as such is directly correlating with the national economy. Municipal waste generation depends on the degree of industrial development, standard of living, lifestyles, social environment, consumption and other indicators of each particular community. Due to this reason, the quantity of generated waste can significantly differ between the countries, and also, within one country.

4.1 Territory and population

The Republic of Serbia covers an area of 88,361 km^2. There are two autonomous provinces in Serbia, Vojvodina (21,506 km^2) in the North, and Kosovo and Metohija (10,887 km^2) in the South. Kosovo and Metohija is under an interim international administration pursuant to Resolution 1244 of the United Nations Security Council and has not been covered in this document. The Republic of Serbia is a country located in the Danube basin, a Balkan country, and South European Country. Its positioning is favourable and is linked to the Central and Western Europe as well as to the Eastern and Southern Europe.

According to the 2002 census, the Republic of Serbia has a population of approximately 7.5 million, whereas 57% of the population lives in urban areas. The most significant agricultural areas are in Vojvodina. There is intensive cow farming, sheep farming and pig farming in the Republic of Serbia. Heavy industry in the Republic of Serbia is mostly connected to mining, and it includes processing industry, metallurgical and chemical industry etc. Other industrial production includes cement and other construction materials, fertilizers, electrical equipment, wood processing, paper, leather and fur products, rubber, textile, food products. The infrastructure investments are increasing. In 2006 the GDP growth was 5.6%, and in 2007 - 7.1%. The 2008 estimate is 6.1%, out of which only 0.35 % of the GDP was spent on the environmental protection from the budget, and the 2009 projections amount to 0.4% of the GDP which is not sufficient. Financial support, out of the National Investment Plan, for 15 projects in the field of environmental protection amounted to 455 million RSD in 2008, out of which 270 million RSD, i.e. 60%, was allocated to 6 projects for regional landfills. Given the worldwide economic crisis, the GDP growth in Serbia will be below the planned one in 2009.

4.2 Municipal waste

4.2.1. Data on waste quantities

Current situation in Serbian local self-government units is characterized by unreliable and incomplete data on the quantity of municipal waste generation. Annual quantities of municipal waste were calculated based on measurement of waste in referent local self-government units. Based on the results of such measurements, it can be adopted that urban population on average generates 1 kg of municipal waste per capita per day, whereas rural population generates an average of 0.7 kg of waste per capita per day. In Belgrade 1.2 kg of waste is generated per capita on daily basis. Based on the census, urban population accounts for 57% whereas rural population accounts for 43%. On average, in the Republic of Serbia 0.87 kg of municipal waste is generated per capita/day (318 kg p.a.).

Detailed data on the municipal waste quantities generated in Serbia p.a. are presented in Appendix 3. The population of 7,443,183 generates approximately 2,374,374 tonnes of waste p.a.

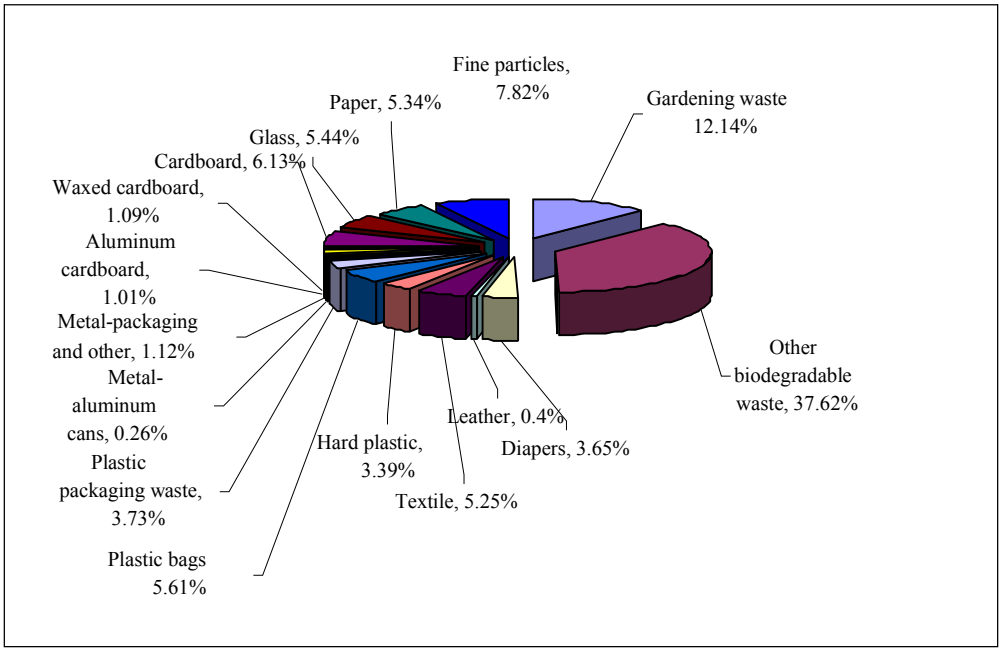

Figure 4.1 Morphological composition of municipal waste in Serbia

Source: Faculty of Technical Sciences, Novi Sad: Determination of waste composition and quantity estimations in order to define strategy of secondary raw material management within the sustainable development of the Republic of Serbia, Ministry of Environment and Spatial Planning, 2008.

According to the morphological composition of waste, organic waste (gardening waste and other biodegradable waste) takes up to almost 50% in the mass of municipal waste, whereas the proportion of other biodegradable waste, with 37.62% , is approximately three times more than the gardening waste. Total plastic waste accounts for the total of 12.73%, whereas the total quantity of cardboard amounts to 8.23% followed by glass (5.44%), paper (5.34%), textile (5.25%), disposable diapers (3.65%) and metal (1.38%).

4.2.2. Current status analysis

Municipal waste is household waste, as well as any other waste which is due to its nature or composition similar to the household waste. It has been estimated that collection rate of organised municipal waste collection amounts to 60% in the Republic of Serbia. Collection is organized primarily in urban areas, whereas rural areas are significantly less covered. Most of local self-government units have the machinery and vehicles for waste collection, however there is a lack of appropriate equipment since different types of vehicles are used for collection: from waste collection vehicles with the press for waste pressing and car-lifters for big containers, up to regular trucks and tractors with trailers.

Waste management problems are not equally and evenly present in all local self-government units, and the activities regarding the introduction of an integrated system are not conducted with the same intensity, but they primarily depend on the capacities of particular municipalities. Such an incoherent system cannot function adequately and the change of such condition in the direction of applying the modern sanitary and safe ways for handling with waste cannot be expected without significant assets. The only economically feasible solution is creation of regional waste management centres where the waste collected from several municipalities will be treated at the plants for separation of recyclable waste and the rest of it will be disposed of at the regional landfills, as defined in the 2003 National Waste Management Strategy. These regions will implement the principles of integrated waste management system for a longer period of time.

There is no systematically organised separate collection, sorting and recycling of waste in the Republic of Serbia. The current degree of recycling i.e. waste utilization is not sufficient. Although, the primary recycling in Serbia has been set forth under the law and envisages separation of paper, glass and metal in specially labelled containers, recycling is not functioning in practice. The exception is one plant for separation of recyclable waste, centres for separate collection of waste at the other location etc.

4.3. Hazardous waste

4.3.1. Data on the waste quantities

Hazardous waste is any waste which, according to its origin, composition or concentration of hazardous substances may cause danger to the environment and human health and has at least one of dangerous intrinsic properties, established by specific regulations, including packaging in which hazardous waste was or is packed. Hazardous waste is listed in all 20 groups according to the Waste Catalogue.

There are no reliable data on the quantity of the hazardous waste generated by the industry. More than 600 companies have submitted the data for the Integrated Cadastre of Polluters (The Pollution Source Registry) which is maintained by the Agency. The information system is being implemented, and it will provide efficient data gathering and analysis on the basis of the different parameters and availability of the data to the public. Although there is legal obligation to submit the data on waste, there is still no response from all the polluters. It is believed that the industrial hazardous waste generation is stagnating because of the reduced industrial activity. However, there is also some residual waste, inherited as a result of the lack of waste management in the previous period. The degree of industrial waste generation per product unit is disproportionately high, the use of raw materials is irrational and industrial energy efficiency is low. According to the preliminary list, there are 156 establishments in Serbia for which integrated permits are to be issued, in compliance with the law. At the same time, those are the facilities which generate the largest quantities of industrial and hazardous waste. Official data state that 31,244 t of hazardous waste was generated in 2007, and 54,022 t in 2008. Hazardous waste is also generated by the operators which are not subject to integrated permitting. Due to their number and wide area of their activities, these operators generate a significant part of hazardous waste. On the basis of these data and the data from Recycling Agency, it is realistically estimated that quantity of hazardous waste generated in the Republic of Serbia in all the plants and establishments, including those that are obligated to apply for integrated permit, is around 100,000 t p.a., while

historical pollution also amounts to approximately 100,000 t p.a. It has been estimated that problem of historical waste will be finally solved before 2019.

4.3.2. Current status analysis

In Serbia there is no location for hazardous waste disposal. In general, there are no authorised facilities for thermal and physical-chemical treatment of hazardous waste. In the recent period hazardous waste solidification and bioremediation processes have been applied. Biological recultivation of ash and slag dumps in TENT A and TENT B is performed in accordance with the "General design of recultivation of ash and slag dumps in public company TPP Nikola Tesla A and Nikola Tesla B". There is no permanent hazardous waste storage area on the territory of the Republic of Serbia. In such circumstances, hazardous waste generators store hazardous waste temporarily in their own locations in temporary storages, although waste has been stored for 20 or more years in some of them. The circulation of waste is subject to the permit system, in conformity with the Law on Ratification of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal as well as the Law on Environmental Protection. Hazardous waste import is prohibited. Exceptionally, certain types of hazardous waste which are needed as secondary raw materials in the processing industry in the Republic of Serbia, in compliance with the national goals of that waste type processing, may be imported according to the permit. The Government decides on the types of the hazardous waste which may be imported as secondary raw materials. Most commonly exported are PCBs, pharmaceutical waste, waste paint and varnish, oil and oil emulsions waste, chemical industry waste, slag, as well as specific types of hazardous waste, characteristic of certain technological processes.

The Republic of Serbia is a member of the Basel Convention and transboundary movement is performed in accordance with the adopted principles. The Ministry is responsible for the database on transboundary movement of waste (waste import, export and transit) on the basis of the permits it issues, which is recorded as a planned quantity of waste which is the imported/exported subject for the time period for which the permit is issued.

4.4. Non-hazardous waste

4.4.1. Data on the waste quantities

The data on the non-hazardous waste quantities are, also, not precise enough. In 2007, the quantity of waste generated by commercial entities which are obliged to pay the fee for generated and disposed non-hazardous industrial waste (data provided by the Fund), was 598,160 t of non-hazardous industrial waste. It is estimated, on the basis of the rest of the data that real quantity is up to 700,000 t per year.

4.4.2. Current status analysis

According to the groups of activities, the highest quantities of waste come from the processing industry, significant quantities of waste come from agriculture, mineral raw materials exploitation and construction industry. Non-hazardous waste is imported for reuse and recycling, and depending on the demand on the market it is also exported. A permit issued by the Ministry competent for the environment is needed for export, import and transit of non-hazardous waste.

Based on the analysis of the statistical data on the transboundary waste movement, it can be concluded that the waste and residues export is dominant in comparison to the import. Most commonly exported are waste metals, especially iron and steel waste. Observed trend is also present with aluminium, copper and copper alloys waste. Waste and residues import is mainly evenly distributed for each type. Transboundary movements of paper and cardboard waste and residues (import – export) are balanced, but the increased import in comparison to export of the plastic waste and residues, as well as the whole waste tyres is the reason for concern.

4.5. Specific waste streams

4.5.1. Packaging waste

Packaging waste is any package or packaging material which cannot be used for the primary purpose, except for the residues generated during the production process. According to the Waste Catalogue, packaging waste is defined under the index number 15 00 00. Packaging is the product made of materials with different features, used for placing, keeping, maintaining, delivery, goods presentation and protection of its contents, and it includes the objects used as additional means for packing, wrapping, tying, impermeable sealing, preparation for consignment and marking of the goods. Packaging can be:

- primary packaging as the smallest packaging unit in which the product is sold to the end buyer;
- secondary packaging as the packaging unit which contains more than one product in primary packaging so that in the retail outlet it provides grouping of certain number of units for sale, whether if it is sold to the end user or it is used for supply in retail outlets. This package can be removed from the product without any influence on its features;
- tertiary (transport) packaging is designed for safe transport and handling the products in the primary or secondary packaging. This packaging does not include containers for road, railway, water or air transport.

The quantity of packaging waste in the Republic of Serbia is neither measured nor recorded systematically. The quantity of packaging waste is estimated to over 334,500 t p.a., based on the measuring in several municipalities, i.e. it includes around 30% of the population. It is estimated that the share of the packaging waste in the municipal waste is around 14%. Serbia needs a packaging waste management system, since the quantity of this waste is constantly increasing due to the growing share of the disposable packaging, especially PET packaging and cans. The greatest part of it is collected with municipal waste and disposed in the dumps. Primary selection of packaging waste is organized in some cities (Čačak).

Table 4.1. Estimated quantities of packaging waste

Waste type	Quantity, t p.a.
Glass packaging	90,000
Plastic packaging	88,000
Paper/cardboard	115,000
Composite packaging	17,300
Aluminium packaging	5,200
Iron packaging	19,000
TOTAL	334,500

Source: Environmental Protection Agency, 2009

Packaging waste collecting is performed within the activity of certain number of mainly privately owned business operators.

Some public utility companies (Belgrade, Novi Sad, Sombor, Kruševac, Smederevo etc.) are registered for the activity of recycling, among other things, packaging waste, mainly plastic, paper and metal.

4.5.2. Used batteries and accumulators

Batteries and accumulators are any source of electric power produced by direct transformation of chemical energy, which may contain one or more primary battery cells (which are not rechargeable), or one or more secondary battery cells (which are rechargeable), while used batteries and accumulators are the ones which cannot be re-used and they represent waste, and they are intended for treatment, i.e. recycling. Used batteries and accumulators are classified as hazardous waste (most often the index number is 06 00 00, from 01 to 03 and 06 according to the Waste Catalogue).

Around 27,000 t of waste lead accumulators is generated in the Republic of Serbia per year, and the entire quantity is recycled. There is no precise data on the quantities of generated waste batteries. Used batteries usually end up in municipal waste landfills. There is no organised system for used batteries management. In some locations the soil is contaminated with acid and waste plastic, which is the result of illegal decomposition of waste lead accumulators. There is a facility which performs organized collecting and handing over of hazardous lead accumulators and provides services to third parties. After handing over, it is recycled completely. Total installed capacities are 25,000 t per year. There is one more facility, which is now in the process of verification of the necessary documents, and its capacity will also be 25,000 t per year.

4.5.3. Waste oils

Waste oils are all mineral or synthetic oils or lubricants, which are unserviceable for the purpose they had been initially intended for, such as hydraulic oils, motor, turbine oils or other lubricants, marine oils, oils or fluids for insulation or heat transmission, other mineral or synthetic oils, as well as oil remains from tanks, oil-water mixtures and emulsions. Waste edible oil is oil generated from tourism and catering activities, industry,

trade and other similar activities. According to the Waste Catalogue, waste oils are placed in several groups, but mostly under index numbers 12 00 00 and 13 00 00.

There are no exact data on the quantities of generated waste oils on the territory of the Republic of Serbia. It is estimated that around 50,000 t of different oils of mineral origin is spent per year. In addition, it is estimated that around 10,000 to 15,000 t of motor oil and other types of oil and lubricants is spent per year on the territory of Belgrade. There is no regulated waste oils collecting system on the territory of Serbia. The capacities for collection and regeneration of waste oils are 25,000 t per year. Some operators collect and store it temporarily. Collection and regeneration of oil from one's own production is much less present, as well as regeneration of oil with the privately owned operators. One part of waste oils is exported for the final disposal, and one is illegally collected and handled, most often for energy recovery. There is a growing trend of organised collecting and handing over of waste edible oils. They are most often used to generate biodiesel. There are certain capacities for treatment of oil emulsions by ultra-filtration and subsequent disposal of generated oil concentrate by the means of solidification process. Cement plants have the capacities for use of waste oils for energy purposes.

4.5.4. Waste tyres

Waste tyres are motor vehicle tyres (cars, buses, trucks, motorbikes etc.), agricultural and construction machines, trailers, towed machines and so on, after the end of their life cycle, i.e. which owner rejects due to damage, wear and tear or due to other reasons. Waste tyres are classified in the waste group with index number 16 01 03 according to the Waste Catalogue.

In the Republic of Serbia, around 1,4 million pieces of new tyres are placed on the market annually, on the basis of which it was estimated that about 18,000 waste tyres are generated annually. One part of the said quantity comes from domestic production, and other part is imported. It is estimated that the existing quantities of waste tyres in Serbia are around 50,000 t, taking into consideration only stocks bigger than 500 t. Increase is expected for 2010 to approximately 26,000 t of waste tyres due to the adoption of new Traffic Safety Law. It is estimated that the problem of the existing waste tyres quantities will be solved by 2014. Organised legal collection and final disposal for energy recovery (co-incineration) is performed by cement plants, which have the permit for use of maximum 15.000 t. There is also organized collecting and export of rubber dust which is generated in the process of protection of spent tyres. In Serbia, there are installed capacities for recycling of waste tyres of different dimensions, currently amounting to 18,000 t p.a. In compliance with the prescribed waste tyres management hierarchy, a proportion of 70:30% was prescribed for 2010, or 80:20% from 2011 and on, which gives advantage to recycling compared with use of waste tyres for energy recovery.

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4.5.5. End-of-life vehicles

End-of-life vehicles, i.e. unserviceable vehicles are the motor vehicles or parts thereof which are waste, and which the owner wants to dispose of. According to the Waste Catalogue, end-of-life vehicles are classified in the group with waste index number 16 00 00.

There are no exact data on the quantities of end-of-life vehicles which are generated during one year. In the Republic of Serbia there are around 1 million vehicles whose average age is more than 10 years. Collection and management of end-of-life vehicles depends mostly on supply and demand. Hazardous substances and components are not extracted before the recycling process of end-of-life vehicles. Parts with use value are extracted in smaller amount, depending on their age and condition. A certain number of operators which are registered for metal waste recycling can meet the legal regulations for end-of-life vehicles recycling. These operators have the capacity to recycle end-of-life vehicles in accordance with regulations.

4.5.6. Waste electric and electronic equipment

Products which need electric power or electromagnetic field to operate, as well as the equipment for the production, transfer and measuring of electricity or electromagnetic field power, constitute electrical and electronic equipment and devices. Waste electrical and electronic equipment includes equipment and devices which the owner wishes to reject, as well as assemblies and components generated in the industry. According to the Waste Catalogue, waste electrical and electronic equipment is placed in the group with index number 16 02 00 and 20 01 00.

Waste electrical and electronic equipment is composed of waste household devices (TV sets, radios, refrigerators, freezers, etc.), personal computers, telephones, cassette recorders, etc. Most of this waste is hazardous waste because of the components it contains. There are no exact data on the quantities of the electrical and electronic waste generated during one year – it is estimated that the quantity generated amounts to 30,000 t per year, while around 40,000 t of the old waste is located in the dumps, various storages and wild dumpsites. 85,600 t of new electrical and electronic devices are annually imported and placed on the market in Serbia. It is not allowed to import used personal computers, i.e. electrical and electronic equipment, except for private use. Collection and management of WEEE is only present in the biggest urban areas. Mainly, waste computer equipment is collected. There are three operators in Serbia that perform organised collection and recycling. Recycling is performed by manual disassembling and separating different types of waste, or mechanically, with manual selection. There are no operators that perform previous extraction of refrigerants from the electrical and electronic waste household devices (refrigerators, freezers, air conditioning units). The management system for electrical and electronic waste is missing. In the Republic of Serbia, only small percentage of electronic waste is recycled per year. A part of the collected waste computer equipment is repaired and placed on the market again. This type of waste has the growth rate of 5% per year in the world, which makes it the fastest growing waste on the planet.

4.5.7. Waste fluorescent tubes containing mercury

There are no data on the quantities of the waste fluorescent tubes. In the Republic of Serbia there is no separate collection of these tubes. They are, together with the municipal waste, disposed in the landfills. At the end of 2008 and during 2009, several operators started collecting and temporarily storing this waste. There is a possibility to install the equipment for its treatment.

4.5.8. Waste contaminated by POPs (POPs waste)

POPs waste is waste which is composed, contains or is contaminated with persistent organic pollutants (POPs), which include PCB waste and waste POPs pesticides (such as DDT). According to the Waste Catalogue, PCB waste is included in groups 13 00 00, 16 00 00 and 17 00 00.

POPs substances are banned from use and must be removed. Some transformer stations are still using PCB (Pyralene oil) as cooling medium, which, compliant to law, must be replaced with appropriate oils which do not contain PCB by 2015. 3,300 tons of waste contaminated with PCB has been identified in Serbia (transformers and capacitors which contain PCB and resistors). Safe storing of PCB does not exist. There is no facility for PCB waste treatment in Serbia and this waste is exported for treatment. There are several authorized private companies which perform taking over and export of PCB waste for treatment in compliance with Law on Ratification of the Basel Convention. There are about 6 t of POPs waste pesticides in Serbia (DDT, Lindane) at 14 identified storages of waste pesticides.

4.5.9. Medical waste

Medical waste is heterogeneous mixture of municipal waste, infectious, patho-anatomic, pharmaceutical and laboratory waste, disinfectants and containers, as well as chemical waste. According to the Waste Catalogue, medical waste is classified in waste group 18 00 00. About 10-25% medical waste is hazardous waste which is dangerous for human health and environment.

Hospitals in the Republic of Serbia have almost 41,000 beds with approximate number of 11 million hospital days. Average annual occupancy of beds is 72%. According to the existing data obtained from medical sector, there are additional 2,700 beds, which are located in military hospitals and private clinics. It has been estimated that all medical institutions in Serbia generate about 48,000 t of medical waste annually. About 9,600 t of this waste is considered infectious, i.e. hazardous waste. Estimated quantity of infectious medical waste which is generated in health institutions, without private and veterinary medicine sectors, is based on the estimate of generation of 0.7 kg of waste per bed daily.

Inappropriate medical waste management is a significant problem due to lack of waste separation in health institutions and landfilling thereof, where such waste was mixed with municipal waste. In 2007, Ministry of Health initiated specific activities related to introduction of uniformed system of medical waste management, particularly with the category of infectious medical waste. 78 autoclaves and crushers for sterilisation of medical waste have been installed in 72 healthcare centres in Serbia, 25 vehicles for medical waste transport have been procured, and training of medical staff for separation

of waste in healthcare institutions has been conducted. Radioactive waste is collected in special containers and is temporary stored in the Institute for Nuclear Sciences Vinča.

National Guide for medical waste management has been prepared, and it is aimed at offering a comprehensive and unified approach to safe medical waste management in state- and privately-owned healthcare institutions and social protection institutions throughout the Republic of Serbia.

4.5.10. Animal waste

Animal waste is generated in slaughterhouses, facilities for meat and fish processing, facilities for animal breeding and farming and similar ones. Treatment of animal waste implies collection, selection according to risk degree (category), storage and treatment. Animal waste is classified in waste group 02 00 00, according to the Waste Catalogue.

There are 900 facilities in Serbia which are registered as slaughterhouses and plants for meat processing. According to available data, generation of animal waste in Serbia (slaughterhouse confiscates and corpses of perished animals) includes 28,000 t annually of perished animals and 245,000 t annually of slaughterhouse waste, of which only approximately 20% is processed in rendering facilities in organised manner. The rest is disposed of without previous treatment to landfills and is buried. There are open-type facilities for animal waste treatment in Sombor, Belgrade (currently out of function), Ćuprija, Zrenjanin, Bačka Topola, Sremska Mitrovica and Vrbas. Closed-type facilities are located in Žitište and Plandište.

4.5.11. Agricultural waste

Agricultural waste is waste that is composed of remains from agricultural, forestry, food and wood industry, and it constitutes significant quantities of waste. Remains from agriculture can be classified into three main groups: waste generated in crop farming, waste which originates from fruit farming and animal waste. Waste generated in animal farming is actually manure which is generated in farming of cows, pigs and poultry. Agricultural waste is classified according to the Waste Catalogue into 02 00 00 and 03 00 00 waste group.

Quantities of agricultural waste amount to some 13 million tons annually (wood waste, remains from agricultural and crop farming activities and liquid manure).

A total of 260,300 cows are raised in Serbia and they generate about 5,270 m^3 of manure, while quantity of manure originating from pigs is somewhat smaller and makes about 4,560 m^3.

Table 4.2. Cattle in medium and big animal farms

Cattle	Area	Number of heads	Generated manure in m^3 daily
Cows	Lowlands	149,300	
	Hills	111,000	
	Total	260,300	5,270
Pigs	Lowlands	1,369,500	
	Hills	285,600	
	Total	1,655,100	4,560
Poultry		2,350,000	480

Source: Ilic,Mladen., Grubor,B., Tesic,M., The State of Biomass Energy in Serbia, Journal Thermal Science, Vol.8 (2004), No.2, pp.5-19.

Waste management in farms is inadequate (there are no facilities for wastewater treatment or facilities to store manure), which leads to pollution of watercourses with nutrients. The World Bank funded a project focused to reduction of pollution of the Danube with nutrients. The Republic of Serbia is at the second place in quantities of phosphates released into the Danube, and at the third place in quantities of nitrates of all 13 countries of the Danube region. The main reason is seen in runoff of untreated wastewaters from big pig farms. The project covered procurement of containers for storage of liquid and solid manure for more than 200 farms – for 24,500 conditioned heads of cows and pigs, as well as equipment for four big slaughterhouses for waste manipulation generated in slaughterhouse industry..

4.5.12. Sludge from municipal wastewater treatment plants

Only about 46% of households in the Republic of Serbia are connected to sewage system. According to data found in Statistical almanac, 363.1 million m^3 of municipal wastewaters are annually generated in Serbia. Out of total quantity of municipal wastewaters, only 5.3% is treated in appropriate manner. Sludge that is generated after the treatment of wastewaters is disposed at landfills, which is currently a quantity of 4,000 tons annually and this does not represent significant load. However, construction of facilities for municipal wastewater treatment will result in generation of big quantities of sludge which should be disposed in appropriate manner. Sludge from facilities for municipal wastewater treatment is in the Waste Catalogue classified into 19 08 05 waste group.

4.5.13. Construction and demolition waste

Construction waste includes waste which is generated in building construction, reconstruction, maintenance or demolition of existing buildings, as well as waste which is generated from excavated material which cannot be used without previous processing. On average, it contains: soil from excavation 75%, waste from demolition and construction (ceramics, concrete, iron, steel, plastic waste, etc.) 15-25%, as well as waste asphalt and concrete 5-10%. According to the Waste Catalogue, construction waste is classified into group with index waste number 17 00 00.

It has been estimated that about 1 million tons of construction and demolition waste are generated in the Republic of Serbia annually. In Serbia, construction waste ends up at landfills for municipal waste and is also used as inert material to cover waste at the landfill. Recycling of construction waste does not exist (asphalt is recycled in small quantities), although about 80% of construction waste can be re-used.

4.5.14. Asbestos-containing waste

Disposal of asbestos-containing waste is not solved in Serbia. Asbestos-containing waste can be found in construction waste.

4.5.15. Waste generated in exploitation of mineral raw materials and waste generated in energy sector

Intensive long-lasting exploitation of mineral raw materials in mining complexes in the Republic of Serbia, in addition to depletion of non-renewable natural resources and causing water and air pollution, has led to significant land devastation and degradation. This phenomenon is particularly expressed in Kolubara and Kostolac basins, where exploitation of lignite which is deposited below most quality soil is being carried out. Open pits and tailing ponds in big mining complexes degraded about 40,000 ha of land. Less than 20% of that area has been covered with natural and artificial recultivation (so far only with greenery). Waste from exploitation of mineral raw materials is classified into waste group 01 00 00, while waste from energy sector in 10 01 00, according to the Waste Catalogue.

There are temporary landfills for drill-in fluids from oil wells in Vojvodina. Landfill has been construction in Novo Miloševo for disposal of this sort of waste and final disposal of 600,000 m^3 of drill-in fluids has been solved. This waste is classified into group 01 05 00.

Thermal power plants which use lignite generate about 5 million tons of flying ashes annually, which is inadequately stored (it covers area of about 1,800 ha). It has been estimated that disposals in Serbia contain about 170 million tons of ashes from thermal power plants.

4.5.16. Waste from titanium dioxide industry

Titanium dioxide is not produced in the Republic of Serbia, but it is used as raw material in production of paints and in industry of construction materials to reach whiteness. There are no available data about quantities of waste which comes from industry that uses titanium dioxide.

4.6. Existing infrastructure for waste management

4.6.1. Existing infrastructure for municipal waste management

Collection of municipal waste in the Republic of Serbia is done mainly by public utility companies whose founders are local self-government units. Organisation of transport and distribution of containers mostly rely on free assessment and earlier practice, rather than on appropriate analyses based on number of gravitating population, frequency of

filling and emptying of containers and capacity of vehicles. In some local self-government units, collection of waste has been entrusted to private sector.

Within the collection and transport of municipal waste, the following may be particularly mentioned:

- Inadequate number and structure of containers for waste collection;
- Inadequate distribution of containers;
- Lack of appropriate vehicles for transport of waste;
- Inadequate frequency of transport of waste;
- Inadequate routes of vehicle moving;
- Unsolved issue of transport of waste from medical centres and some commercial entities.

Centres for separate collection of waste exist in Belgrade, Čačak and sporadically in other local self-government units in the Republic of Serbia, where municipal waste is collected in separate containers intended for collection of different types of waste (metal, glass, paper, PET, cans and so on). For now, there is a facility for waste separation of recyclable waste in Novi Sad. There are several registered facilities for recycling of PET, metal, plastic etc. materials. Even though municipal waste contains high degree of organic components, there are no facilities for biological treatment of municipal waste. There are no facilities for incineration of municipal waste in Serbia.

Waste landfilling is the only way of organised handling with waste. In the Republic of Serbia, each local self-government unit still has its own landfill – dumpsite. Capacity of the existing landfills – dumpsites has already been filled up in most of municipalities, while most of landfills do not fulfil even minimum of technical standards. There is no controlled capture of landfill gas which is generated in waste decomposition at the landfill, which may result in fire or explosion. Leachate waters from landfills are neither collected, nor treated, which may endanger ground and surface waters and soil due to high content of organic substances and heavy metals. There is no systematic monitoring of emissions, leachate waters, landfill gas etc.

Municipal waste which is collected in organized manner is disposed at 164 officially registered municipal landfills. Landfill “Vinča”, the biggest one in Serbia, receives daily about 1,700 tons of municipal waste from households and non-hazardous industrial waste from 12 Belgrade municipalities. There is no pre-treatment before disposal. Land where landfills are located is most commonly owned by the Republic of Serbia. Age of those landfills varies from 4 years (Bačka Palanka – Obrovac, Bela Palanka, Malo Crniće, Pančevo and Tutin) to 53 years (site in Silbaš, municipality of Bačka Palanka, which has been in function since 1956). Data about dimensions and volume of landfill bodies are not reliable, bearing in mind that most of them do not have adequate technical documentation. About 70% of all active landfills – dumpsites are not stipulated through spatial planning documents and no environmental impact assessment study has been developed, nor do they have necessary permits. As for devices needed for levelling and compressing of waste at landfills, mostly bulldozers are used, while compactors are used for waste compression at 10 landfills. Mechanization is occasionally serviceably rented at several landfills. Self-ignition often occurs at dumpsites, which results in emission of pollutants. Landfills – dumpsites with highest environmental and human health risk are those which are located less than 100 m far

from the settlement (12 landfills) or at less than 50 m far from river bank, stream, lake or accumulation (25 landfills, of which 14 landfills are located exactly at the watercourse bank). The Fund allocated funds to co-finance, with contribution of 40-60%, development of technical documentation and rehabilitation of about 80 landfills – dumpsites for municipal waste. After the rehabilitation, most of so-far disposal sites may be turned into transfer stations and centres for collection of recyclable waste, while the remaining ones will be closed through construction of regional landfills.

Wild landfills, which are out of control of municipal public utility companies, receive about 40% of generated municipal waste in Serbia, and there are 4,481 of them according to latest report from the inspection made in 2009. In most cases, wild landfills are located in rural areas and they are consequence of, primarily, insufficient funds for extension of waste collection system, but also of bad organisation of waste management at local level. In addition to these, wild landfills are also often created along traffic roads, of which high percentage is located at slopes of road dykes, from where waste is simply thrown from trucks. Such landfills are most commonly inaccessible for removal. Also, natural depressions, pits and karst sinkholes are used for disposal of waste, where cleaning is practically impossible.

According to the National Waste Management Strategy from 2003, it was stipulated to close down and recultivate existing dumpsites and to construct 29 regional sanitary landfills, with centres for separation of recyclable waste and transfer stations. At the territory of AP Vojvodina, proposal for micro locations has been developed on the basis of geological, hydrological and infrastructure criteria, in compliance with the Strategy and Study of Spatial Distribution of Regional Landfills and Transfer Stations. By December 2009, the established regions for waste management were in some cases organised in different manner than it was proposed in the 2003 National Strategy.

Most of the local self-government units still have not come to the agreement, nor have they entered into agreements or contracts related to the establishment of waste management regions.

Main challenges of waste management in Serbia still pertain to provision of good coverage and capacities for basic service provision, such as collection, transport and sanitary disposal of waste.

4.6.2. Existing infrastructure for hazardous waste management

Lack of infrastructure for treatment and disposal of hazardous waste makes a particular problem. There is no facility for treatment of hazardous industrial waste ate the territory of the Republic of Serbia (there are some registered facilities for physical treatment of specific waste streams which fall into the hazardous ones). There is no location either regulated for disposal of hazardous waste, nor are there central storages. Hazardous waste is temporarily stored in inadequate storages, out of which some are several decades old, or at factory landfills. Analyses have shown that 62% of temporary storages of hazardous waste do not meet prescribed conditions, and that only 5% of hazardous waste is temporarily stored in a prescribed manner. Therefore, needs for exports of hazardous waste for treatment are ever growing.

Spatial plans in the Republic of Serbia have not defined locations for construction of facilities for hazardous waste management, and for now, there is no approved location for landfill of hazardous waste in Serbia. There is resistance among local residents against location of facility for treatment and disposal of hazardous waste close to them. This occurs due to low level of knowledge and information provision about problem of waste, distrust and insufficient public participation in decision-making processes. Construction of the facility for hazardous waste treatment is one of priorities of the Government of Serbia, which is underlined in the Council Decision on the principles, priorities and conditions contained in the European Partnership (2008/13/EC). A part of production capacities with possibility of thermal treatment of waste is not utilised enough (cement kilns, steel mills and thermal power plants). Co-incineration of waste is experimentally applied in cement factories (waste tyres).

Lack of infrastructure for waste treatment in the Republic of Serbia has opened sole possibility for final disposal of waste, that is, its export for treatment into authorised and registered facilities in the EU (incinerators, facilities for physical-chemical treatment, etc.). The facilities which export waste come from the area of pharmaceutical industry, electrical energy, laboratory waste and from some medical institutions. PCB waste makes the majority of exported waste.

4.6.3. Existing infrastructure for medical waste management

Separation of infectious medical waste from other one has started in public and private healthcare institutions and veterinary organisations. Used needles and syringes, cotton pads, incontinence diapers, bandage materials and other categories of infectious waste are treated in 72 healthcare centres in the Republic of Serbia where 78 autoclaves and crushers have been installed for sterilisation of medical waste (devices for low-temperature treatment of a part of medical waste, which can be landfilled after such treatment – disinfection/sterilisation of infectious waste and sharp objects – crushing/grinding of sterilised waste). Generally, the Republic of Serbia does not have any modern facilities for incineration of medical waste.

4.6.4. Existing infrastructure for specific waste streams

Currently, there are no organised waste recycling capacities in place. The Recycling Agency's database contains 302 commercial entities registered for activities of collection, treatment, import and export of secondary materials. For the most part, these commercial entities are involved in collection and trade in industrial secondary materials. The majority of registered commercial entities are in Belgrade - 65, then in South Bačka County - 31 and Moravički County - 25 commercial entities.

The majority of the commercial entities are registered for recycling of metal waste – 211. In addition, 4 commercial entities deal exclusively with used lead accumulators. There are several facilities for recycling of specific waste streams: waste tyres, waste oils, plastic and PET. There are 29 commercial entities registered for treatment of waste plastic, 16 commercial entities for treatment of waste paper and cardboard, 14 commercial entities for treatment of waste tyres, 6 for waste textile, 2 for glass chips, and 8 commercial entities for recycling of toner cartridges. One commercial entity is registered for use of waste tyres as alternative fuel. Also, according to the needs, some

commercial entities are themselves starting to organise collection of secondary materials.

There are no registered facilities for recycling of waste vehicles, but such activity is now being performed in several facilities for recycling of metal waste. Open-type facilities for animal waste treatment are located in Sombor, Belgrade (currently out of operation), Ćuprija, Zrenjanin, Bačka Topola, Sremska Mitrovica and Vrbas.

4.7. Waste management status assessment and SWOT analysis

Notwithstanding the actions taken, waste management performance is not satisfactory. Organized collection of municipal waste covers only around 60% of population, whilst rural areas are not sufficiently provided with organised waste collection. Waste is being disposed to official landfills which often fail to comply even with the minimum technical standards. There are 4,481 wild landfills in Serbia. Construction of several regional landfills – regional centres for waste management is anticipated to start. Separate collection and recycling of packaging waste and other municipal waste is not implemented. Performance of hazardous waste in Serbia is an issue and solving it requires an integrated approach. There is no permanent hazardous waste storage for now that complies with regulations, and temporary disposal is mainly performed in-house and often inadequately. There are no facilities for hazardous waste treatment. There is no system for separate collection of medical waste. Public awareness of waste treatment is not sufficiently developed. There is no education for population regarding waste, treatment methods and obligation to recycle.

The following problems of waste management in Serbia were identified: lack of infrastructure for treatment and disposal of waste, joint disposal of municipal and hazardous waste from households, lack of data on waste composition and streams, absence of facilities for storage, treatment and disposal of hazardous waste, absence of separate collection and treatment of medical waste, pollution of soil, surface water and ground water by waste.

SWOT analysis

STRENGTHS	**WEAKNESSES**
1. Existence of national waste management strategy; 2. Adopted key laws on waste management harmonised with EU Directives; 3. Started construction of several regional sanitary landfills – regional centres for waste management; 4. Unused potential for waste recycling 5. Possibility of waste incineration in cement plants, thermal power plants	1. Lack of infrastructure for treatment and disposal of waste (regional landfills – regional centres for waste management, facilities for recycling, composting etc.); 2. Absence of facilities for treatment of hazardous waste; 3. Absence of central storage for hazardous waste; 4. Pollution of waters, soil and air due to poor waste management practice; 5. Degraded areas due to inadequate waste disposal and numerous dumps and wild landfills; 6. Absence of organized collection and disposal of waste in rural areas; 7. Lack of accurate data on quantity of waste that disappears;

	8. Limited capacities for recycling of waste
OPPORTUNITIES 1. Introduction of the EU waste management standards; 2. Integration process and use of the EU and other funds 3. Rehabilitation of unregulated dumps and remediation of contaminated soil; 4. Reduction of industrial waste generation; 5. Contribution to employment and opening of new jobs; 6. Charging by quantity of generated municipal waste	**THREATS** 1. Lagging of legislation and institutional reforms; 2. Lack of investment for development of waste management infrastructure; 3. Areas burdened by uncontrolled and unhygienic landfills – dumps; 4. Insufficiently developed public awareness of necessity to treat waste properly; 5. “Not in my backyard” principle; 6. Inability of citizens to pay the real, economic price for municipal services

5. WASTE MANAGEMENT OPTIONS

Integrated waste management includes taking waste into account as of its generation, minimization, through collection, transportation, treatment to disposal. In order to have a sustainable waste management system it is necessary that all options of waste treatment should be taken in consideration. The decision on the most favourable option for the waste treatment will be made through the analysis of the waste life-cycle and the characteristics of the environment and the site at which the waste has been generated.

Important conditions influencing the decision on the use or disposal of waste are as follows:

- increased demand for ecologically safe waste removal, leading to greater costs of waste disposal;
- the application of principles of collection of actual costs of waste disposal charged to a polluter, creator of waste;
- development of new production technologies and procedures for the use of waste;
- market research with respect to the placement of recyclable products.

The concept of hierarchy in waste management shows that the reduction of waste creation is the most effective solution for the environment. However, in cases when the reduction of waste generation is not applicable in practice, the products and the materials may be re-used, either for the same or some other purpose. In lack of such possibility, the waste may be further used through a recycling process or composting, or through the process of energy recovery. The waste should be landfilled only if none of the above options offers appropriate solution.

5.1. Reduction of waste at its source

Unlike other options in the waste management hierarchy, the reduction of waste is not the option that may be chosen in lack of other options. The waste reduction should be taken into account each time the use of resources is subject to decision-making. The reduction must be designed as to the life cycle of a product, i.e., already in the design phase, through manufacturing, packaging, transportation and product placement. Consumers should also take an active role in the reduction of waste by purchasing products with less packaging material. The Government should be the holder of the waste reduction policy.

5.2. Re-use

Some products have been specifically designed to be used several times. The implementation of the provisions on packaging material in the EU resulted in the encouragement to manufacturers to take into consideration the application of packaging material for multiple uses. In other cases, the products may be treated for the same or similar purposes. There are good reasons for products re-use, since the following is achieved:

- cost reduction both for manufacturers and consumers;
- savings in energy and raw materials;
- reduction of waste disposal costs.

5.3. Recycling

It is virtually impossible to give a decisive answer to question whether recycling is more important in the sphere of industrial or municipal waste, since in both cases significant technical, environmental and economic effects are obtained. The most important effects out of them are certainly: drastic reduction of quantities of industrial and municipal waste that must be disposed to sanitary waste areas, by which the period of waste area use is prolonged and the process of exploitation of natural resources and emissions from waste area is slowed down.

- knowledge of limited natural resources and the need of rational use of what we have at our disposal;
- environmental protection regulations prescribe stricter criteria for waste disposal, therefore it is necessary that the waste volume that is landfilled should be reduced by recycling;
- problems in providing sites for new landfills indicate that the recycling process should be one of the possibilities to reduce the needs for new landfills.

The typical components of the waste recycling system in term of using the materials and the isolation of useful waste are, as follows:

- isolation of different components at the point of waste creation – from a household, retail, institutions, waste collection in streets or in centres where recycled waste is collected (primary recycling process);

- isolation of recyclable materials out of the total waste volume in plants for separation of recyclable waste;
- preparation of isolated recyclable materials in the piling lines (paper, plastic), pressing (metal), grinding (glass).

5.4. Composting

Composting is defined as a fast and partial decomposition of wet solid organic matter, food scraps, garden waste, paper, carton by means of aerobic micro-organisms and under controlled conditions. As a result of this process, a useful material is obtained similar to humus, with the absence of unpleasant odour and can be used as soil conditioning agent or as a fertilizer.

The advantages are as follows: the end-product has a certain market value that should result in the return of a certain part of invested funds; the space needed for the site of the plant is comparatively small and the prices of transportation are not so high. On the other hand, such plants may require great capital investments as well. The market for the obtained product is not always secure, and the warehousing of the end-product may also be a problem. The quality of a composted product is important in case it has its market. The experience shows that although the organic material from a waste area may be successfully transformed in compost, the contamination (particularly coming from glass, metal and plastic particles) makes potential consumers unwilling to use it. Thus the organic waste for composting should be separated at its source and before disposal to a waste area.

In principle, composting is conducted in two phases:

- collection and separation of organic components (kitchen waste and garden waste) for composting in compost fields or in particular plants (often of regional type);
- promotion of independent composting “in one’s own yard” through education and establishment of small bunkers for composting.

With respect to the EU Directive on landfills and the prohibition of biodegradable waste landfilling, composting became significant as an alternative option for biodegradable waste treatment.

5.5. Anaerobic digestion

Decomposition of organic, biodegradable part of solid waste in gases with high share of methane may be achieved by anaerobic decomposition or anaerobic fermentation in a reactor. After the fermentation of organic waste separated at the source, the remains of the fermentation (digestat) is normally treated aerobically until compost is obtained. In that manner, the final result of waste fermentation is in most cases similar to aerobic composting. The result of the decomposition process is biogas, compost and water. Wastewater, obtained in treatment process is treated and one part of it may be recirculated.

5.6. Waste incineration

The technology of burning (incineration) of waste represents the oxidation of flammable materials contained in waste. The incineration of waste is applied in view of reducing the waste volume, and the energy generated in the process of burning may be used for obtaining thermal or electrical energy. However, economic viability of energy use is not always acceptable at first sight, and it should be taken in consideration that the investment and operational costs of incinerators in accordance with the EU regulations are high, and in general higher than the costs of waste disposal to sanitary landfills for municipal waste (sometimes six times higher). It means that the incineration is an important and useful way to reduce waste, and the problems accompanying waste disposal to landfills may be avoided for a long period of time.

Hazardous waste generators may have their own plants for incineration or the waste may be sent to a company dealing with incineration on behalf of waste generator for a fee. In accordance with EU regulations, infectious medical waste must be initially burnt in incinerators designed for that purpose. At the same time, the possibility of the application of autoclaving method "*in situ*" is not excluded, after which the disposal to municipal landfill takes place.

In order to have a sustainable system of waste management, the incineration of waste together with the energy use should be a complete and integral part of local and regional solutions that must be developed in the period to come. The incineration of waste together with the energy use must be considered in the context of integrated approach to waste management that means reduction, re-use and recycling. When the incineration with the energy use is the most practical environmental option, it is necessary that the possibility of obtaining a combination of thermal and electrical energy should be considered in view of increasing the process efficiency.

5.7. Other waste treatment processes

In order to have a sustainable system of waste management, it is necessary that all options of waste treatment should be taken in consideration. New technologies, in case they are reliable and competitive in comparison to other options, may also find its place in the system. Some of these options are as follows:

Pyrolysis

Pyrolysis is the process in which organic waste gets decomposed at high temperatures and in absence of air. During the process, thermal decomposition of organic substances takes place resulting in pyrolytic gas, oil and solid phase rich in carbon. According to temperature range at which pyrolysis takes place, three types of pyrolysis may be distinguished:

- low temperature pyrolysis at temperatures up to 500°C;
- medium temperature pyrolysis at temperatures from 500°C to 800°C;
- high temperature pyrolysis at temperatures higher than 800°C.

The increase of the reaction temperature results in the increase in share of pyrolytic gas in reaction products, and in decrease in solid and liquid phase. Pyrolytic gas is usually burnt. Flue gases are used for heating or generating electricity.

Gasification

Gasification is high temperature process of waste treatment in presence of air or water steam applied to obtain flammable gases. The technology is based on a famous process of gas production out of oil. The product of reaction is the mixture of gases. Gas obtained in this manner may be burnt or used in plants for co-generation. Due to high temperatures of the process, the vitrification of slag obtained in the process takes place. Gasification is not still a widespread procedure for waste treatment since fuel must be of comparatively homogenous composition, which means that municipal waste must be subject to pre-treatment.

Plasma process

Alternative systems of treatments such as plasma process (energy released by electric charging in inert atmosphere) have been developed. Temperatures between 5,000°C and 15,000°C are achieved in this process. Due to high temperatures, organic substances are decomposed out of waste and non-organic substances are melted. Intensive decomposition of organic molecules takes place in the gas phase, which completely eliminates toxic emissions. At the same moment, it is the main advantage of plasma procedure. Inorganic substances are vitrified after melting therefore they may be used as a supplement to construction material to which they can be safely disposed. This system is extremely expensive and is still not very much used.

Waste as fuel

Some industrial processes and plants for energy generation operate under the conditions allowing the use of waste with high thermal potentials instead of conventional fuels. The most usual example is cement production where high temperatures and long periods of energy retaining ensure a complete burning of waste. Typical waste burnt in these processes includes municipal waste, tyres, used solvents, refinery waste, fat bone powder, etc. Thermal power plants and city heating plants providing cities with thermal energy may also represent a significant infrastructure for waste burning. Integrated prevention and pollution control define the limits within which primary fuel may be replaced by waste. The EU Directive on waste incineration prescribes allowed cut-off values of emission for the plants using alternative fuels.

Physical-chemical treatment of waste

Physical-chemical treatment of waste includes: neutralization, mineralization, solidification, oxidation, reduction, adsorption, distillation, ionic changes, reverse osmoses and other physical-chemical and chemical processes by which toxic features of waste are reduced. Solidification is the term used for a wide range of treatments changing physical-chemical characteristics of waste aimed at making it suitable for landfilling. The solidification is applied in treatments of liquid waste and sludge containing heavy metals and toxic waste. The aim of solidification is to convert waste to

a form in which its constituents are immobilized so that they could not be discharged to the environment.

5.8. Waste landfilling

There are three types of landfills for waste disposal:

- landfills for disposing of non-hazardous waste;
- landfills for disposing of inert waste;
- landfills for disposing of hazardous waste,

Certain types of waste are disposed of in landfills designed for that type of waste. The so-called sanitary landfills are used for a disposal of non-hazardous waste and they represent sanitary-technically arranged space in which waste generated in public areas, households, production process, work process, sales or use, that contains no hazardous substances and that cannot be processed and/or rationally used as industrial raw material or energy fuel, is disposed. Landfills envisaged for the disposal of hazardous waste are designed with special technical requirements. Hazardous waste disposed in these landfills must be pre-treated in accordance with regulations. Landfills are necessary in each chosen option of treatment, because there is always a part of waste that must be disposed.

6. WASTE MANAGEMENT OBJECTIVES

6.1. General objective

To develop a sustainable waste management system in order to reduce environmental pollution and spatial degradation.

6.2. Specific objectives

Short-term objectives (2010-2014)

- Harmonize national regulations in the sphere of waste management with the EU legislation;
- Adopt national plans for certain waste streams;
- Develop regional and local waste management plans up to 2014;
- Increase number of citizens included in the system for waste collection to 75 % by 2014;
- Develop the system of primary selection of waste in local self-government units;
- Construct 12 regional centres for waste management by 2014 (regional landfills, plants for the selection of recyclable waste, plants for separation of recyclable waste, plants for a biological treatment of waste and transfer stations in every region);
- Establish the system of hazardous waste management (establish central regional storages for hazardous waste and start the construction of the plant for physical-chemical treatment of hazardous waste by 2014);

- Establish the system for the management of specific waste streams (waste tyres, used batteries and accumulators, waste oils, end-of-life vehicles, WEEE);
- Establish the system for the management of medical and pharmaceutical waste;
- Establish the system for the management of waste of animal origin and adopt a relevant regulation;
- Encourage the use of waste as an alternative fuel in cement plants, steelworks plant and thermal plants, in accordance with the principle of waste hierarchy;
- Improve the sanitary conditions of current landfills that represent the highest risk for environment and of sites called "hot spots" from historical pollution with hazardous waste.

Long-term objectives (2015-2019)

- Introduction of separate collection and treatment of hazardous waste from households and industry;
- Construct 12 regional centres for waste management – regional landfills, plants for the selection of recyclable waste and transfer stations in each region;
- Provide the capacities for burning (incineration) of organic industrial and medical waste;
- Strengthening professional and institutional capacities for hazardous waste management;
- Achieve the level of re-use and recycling of packaging material waste (glass, paper, carton, metal and plastic) of 25% of its volume;
- Establish the system of construction waste management and the asbestos-containing waste.

6.3. Key principles in waste management

The key principles that must be taken in consideration when establishing and implementing the waste management plan are as follows:

- Sustainable development principle;
- Principle of hierarchy in waste management;
- Precautionary principle;
- Principle of vicinity and regional approach in waste management;
- Principle of selection of the most favourable option for the environment;
- "Polluter pays" principle;
- Producer liability principle.

Sustainable development principle

The definition of sustainable development postulates the fulfilment of needs of today's generations without threatening the rights of future generations to meet their needs. The

principle promotes an equal development with the economic growth ensuring the reduction of poverty, fair distribution of wealth, improvement of quality of life and reducing the level of pollution to the level of capacities of environmental factors, prevention of future pollution and biodiversity conservation. This sustainable waste management means more efficient exploitation of resources, reduction of quantity of generated waste, and once the waste has been generated, its handling in such a manner to contribute to the objectives of a sustainable development.

Principle of hierarchy and waste management

The hierarchy in waste management means the order of priorities in the waste management practice:

- Prevention of waste generation and waste reduction, and/or reduction of exploitation of resources and reduction of quantities and/or hazardous characteristics of generated waste;
- Re-use, and/or re-utilisation of products for the same or other purposes;
- Recycling, and/or treatment of waste for the purpose of obtaining raw materials for the production of the same or other product;
- Use, and/or utilisation of waste values (composting, burning with energy recovery, etc.);
- Waste landfilling.

Precautionary principle

The precautionary principle means that “in case there is a possibility of a serious and reversible damage, absence of full scientific reliability may not be the reason for not taking measures for preventing the degradation of environment”. Each activity must be planned and implemented in such a manner so as to cause the least possible change of the environment. In case of potential and significant impacts on environment, preventive activities should be taken, while application of environmental impact assessment instruments should be particularly supported.

Principle of vicinity and regional approach in waste management

The waste is treated or disposed to places as close to its generation as possible, and/or in the region in which it has been generated so that unfavourable environmental consequences during transportation could be avoided. The selection of the site for the plant for the treatment and disposal of waste will be carried out depending on local conditions and circumstances, type of waste, its volume, manner of transportation, economic viability, as well as on potential environmental impact. Regional waste management is ensured by development and implementation of regional plans based on the European legislation and national policy.

Principle of selection of the most favourable option for the environment

The choice of the most favourable option for the environment is a systematic and consulting decision-making process, including environmental protection and the conservation. The application of the selection of the most favourable option for the environment establishes, for given objectives and circumstances, the option or the

combination of options that provides the highest benefit and the least harm for the whole environment, with the acceptable costs and profitability, both in a long-term and in a short-term run.

"Polluter pays" principle

A polluter must bear full costs of the consequences of their activities. The costs of generation, treatment and disposal of waste must be included in the price of a product.

Liability principle

Producers, importers, distributors and sellers of products influencing the increase of waste volume are responsible for the waste generated as a result of their activities. The producer bears the greatest responsibility because he influences the composition and the characteristics of a product and its packaging material. The producer is obliged to take care of the generation of waste, development of recyclable products, development of the market for re-use and recycling of their products.

7. WASTE MANAGEMENT CONCEPT

7.1. Waste quantity estimations

When estimating the municipal waste that will have been generated by 2020, the change in number of citizens and the change of citizens' standards of life have been taken into account. Also, the estimation of increase of number of citizens covered by the system of organised collection of municipal waste from today's 60% to 90% in 2020 has been taken into account (Appendix 3).

The estimation of hazardous waste generation by 2020 will depend on industrial operation and it is expected that the quantities of approximately 100,000 t/p.a. in 2008 will be increased to 200,000 t/p.a. in 2020.

The estimation of volumes of non-hazardous industrial waste will also depend on industrial operations, but they are expected to increase by 2020 at the rate of 4% annually and in 2020 they will reach the amount of 1.1 million t /p.a.

7.2. Organisation of waste management system

The Strategy governs the management of different types of waste in the territory of the Republic of Serbia, from the moment of its generation until its disposal, with the basic aim to establish an overall system of waste management that will be organised in accordance with the national and European requirements and standards. The objectives of the waste management system are:

- reducing the quantities of waste being generated;
- reducing the quantities of waste landfilled with a primary selection of useful waste;
- reduction of the participation of biodegradable waste in disposed municipal waste;

- reduction of a negative impact of disposed waste on the environment, climate and human health;
- management of generated waste on the basis of sustainable development principles.

The waste management system will be organised as an integrated system, with all the participants in the system on a national, provincial and local level.

In the short-term period, all local self-government units will be obliged to prepare regional and local plans for waste management. New regional sanitary landfills are expected to be constructed, as well as transfer stations, plants for separation of recyclable waste, improvement of sanitary conditions in the existing dumpsites representing the greatest risk for the environment, extension of the capacities for waste collection, etc. The spatial plan should determine the sites for regional waste management centres. Agreements on joint waste management must be entered into by municipalities. A regional waste management company must be established. In case of disagreement between local self-government units in terms of determining the sites for waste management plants, the decision on the site, at the Ministry proposal, and/or competent authority of autonomous province, will be made by the Government. The Fund will finance the rehabilitation of the landfills only in regions that have signed the agreements.

Utility servicing activities in Serbia are usually under the competence of public utility companies established by local self-government. Therefore, there is no motivation to increase the efficiency, or to increase the quality of service. In some local self-government units there are agreements with strategic partners on the collection and disposal of waste. The reform of utility services requires a completely new framework, regime of control and institutions that will implement that regime. The improvement of utility services must be systematically based on the savings of funds and integration with local self-government in the region. Reforms in this area should be implemented in the upcoming period. The users of services require better quality and harmonization with international or national standards, as one of the ways to protect the environment. By the adoption of international standards in the sphere of environmental protection, necessary conditions for the development of a regional economic policy are provided as well. Encouraging competition and participation of private sector in the sphere of service provision are recommended, particularly in the waste management sector.

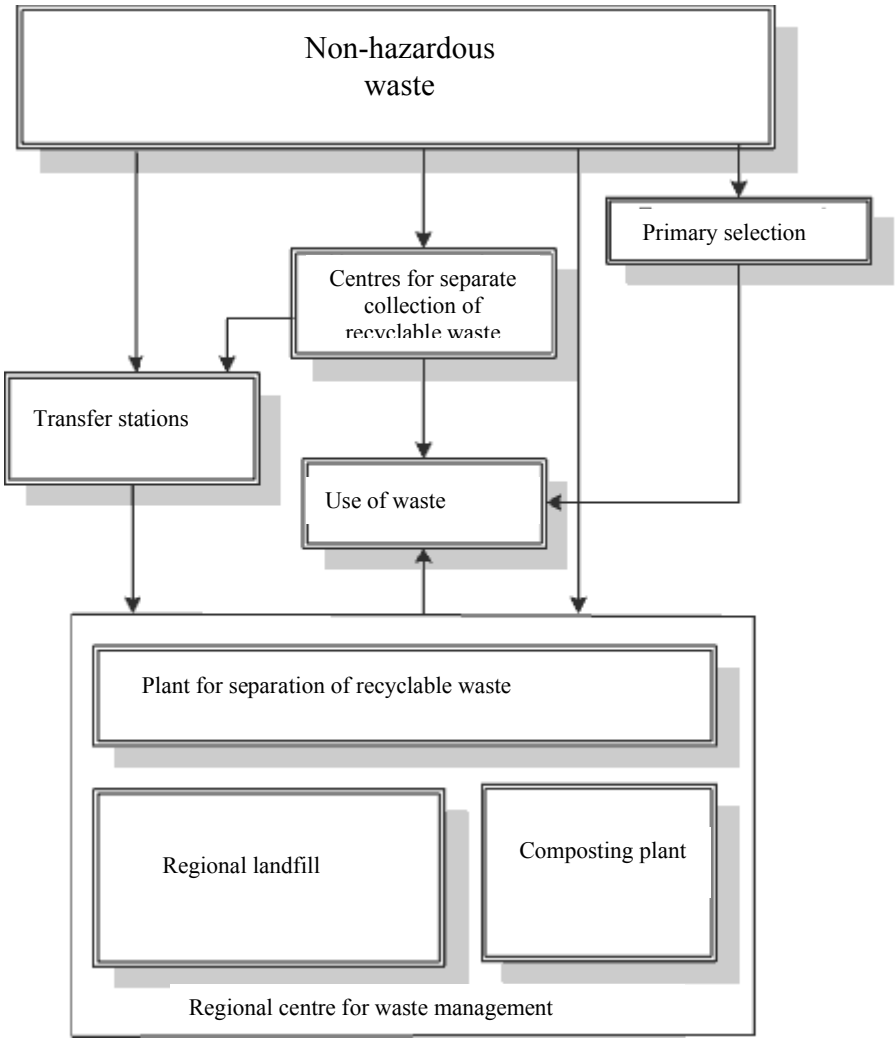


Figure 7.1. Scheme of non-hazardous waste management in Serbia

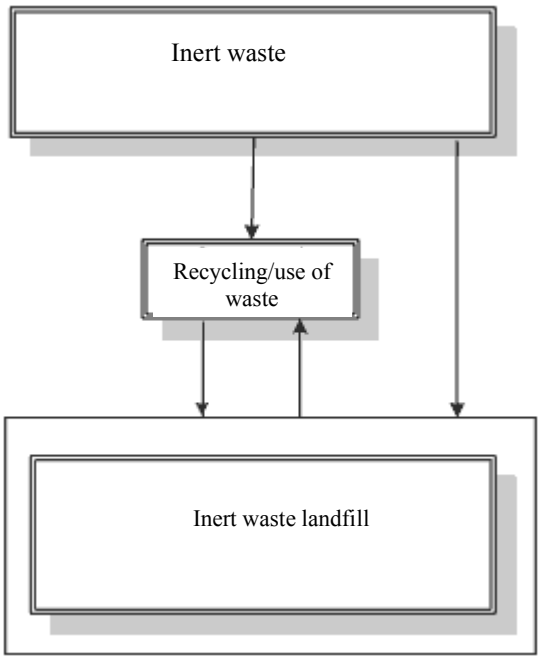


Figure 7.2. Scheme of inert waste management in Serbia

It is also necessary that the construction of the plant for hazardous waste treatment should be started. During the first phase it will refer to physical-chemical treatment of inorganic waste and the construction of several regional storages for hazardous waste. Based on the Law on Waste Management, the system of specific waste streams management is established and economic instruments are introduced.

As one of the priorities for resolving the problems of hazardous waste, it is necessary that the possibilities and conditions for using the existing plants and installations should be taken in consideration (cement plants, thermal plants, heating plants, steelworks plants) for the purpose of hazardous waste treatment.

In the long-term period we should focus on the achievement of the objectives in recycling waste and complete the establishment of regional centres for municipal waste management in all regions. The construction of a plant for energy recovery from municipal waste, as well as construction of a central plant for hazardous and medical waste incineration is also planned.

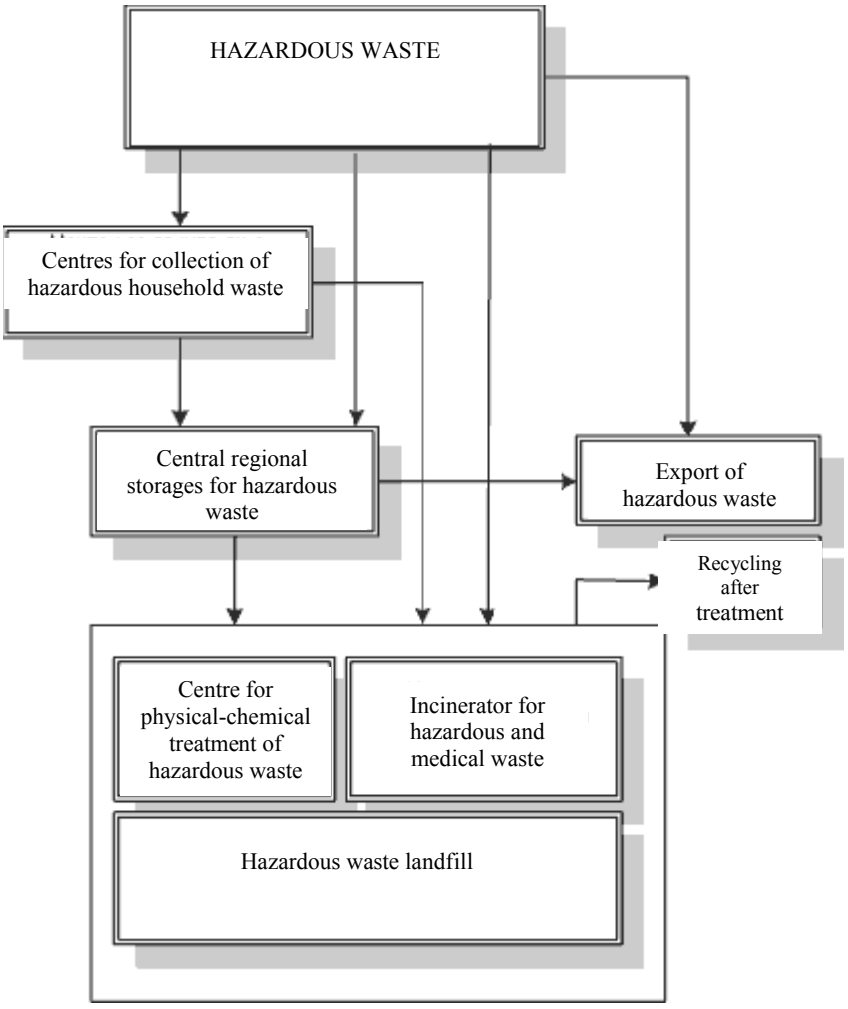


Figure 7.3. Scheme of hazardous waste management in Serbia

7.3. Activities in certain waste streams

7.3.1. Municipal waste

Municipal waste management falls under the competence of local self-government units. It is necessary to strengthen the institutions and authorities in charge of planning and management of projects, issuance of approvals, control and monitoring, as well as administrative capacities for more efficient implementation of regulations in this field. On the basis of the Law on Waste Management, all regions and municipalities should adopt their waste management plans. Spatial plans must identify the sites for municipal waste management plants. Development of public awareness and education of staff remains a permanent activity. It is necessary that centres for separate collection of recyclable waste (paper, cans, glass, plastics, electrical devices, clumsy waste material, etc.) should be established and promoted where citizens themselves would bring the waste. Local self-government units should provide for and equip those centres. Local self-government units should be focused on the organisation of primary selection through the organised collection of recyclable waste in households. Doing so, quality secondary raw

materials will be obtained which can be readily used in the market. Regional waste management centres with all necessary infrastructure should be established: transfer stations for re-load of waste, regional landfill, plant for the separation of recyclable waste and the plant for composting. It is necessary to rehabilitate the existing landfills. The establishment of plants for energy recovery from waste has been planned in the long run. It is necessary that heating plants and cement plant should take into consideration the burning of municipal waste as alternative fuel. The most important objective is the financially sustainable activity of waste management based on the "polluter pays" principle. The principle of full costs recovery for the services of collection and disposing of waste should be applied, as well as the introduction of stimulation instruments for re-use and recycling of waste. The charging should be carried out according to the quantity of generated waste, not according to the size of immovable property, and/or square meter of residential space, since in that case there is no motivation for reducing the volume of waste at the source and there is no motivation for recycling. In order to achieve the objectives set in the municipal waste management plans, the Agency will monitor their implementation in accordance with the Law on Waste Management. The Ministry and other competent authorities are obliged to apply the principle of waste reduction when granting approvals in relation to the environmental impact assessment IPPC permitting.

7.3.2. Hazardous waste

In order to build professional capacities for hazardous waste management in Serbia, it is important that exact quantities of hazardous waste generated on the annual basis are determined. The Agency should establish and maintain the database of all hazardous waste generators. The centres for hazardous household waste collection which may operate within the centres for recyclable waste collection should be established. These could also be mobile centres. It is necessary that once or twice a year the actions of hazardous household waste collection should be organised, where the citizens would be informed about mobile centres for hazardous household waste collection. The establishment of systems for hazardous waste management includes the establishment of adequate collection and transportation of hazardous waste, construction of five regional storages for hazardous waste that is stored for further treatment, the construction of plants for physical-chemical treatment of hazardous waste within the centre for hazardous waste management, the construction of two incinerators for hazardous waste, as well as the hazardous landfill. Hazardous wastes that cannot be treated in the country should be stored temporary in storages for collection and export of hazardous waste to authorized plants. These temporary storages should serve to an exporter of hazardous waste only for collection and re-packing of hazardous waste intended for export. The capacities of cement industries and thermal plants should be used preferably for incineration of certain types of hazardous waste, with the full control of emissions. The permit for waste management will define the requirements that must be met for the activities in the plant.

The mechanisms for resolving historical pollution, and/or removal of damage to environment due to inadequate waste management should be developed. It is necessary that the sites polluted with hazardous waste should be identified, risk assessment should be made and the priorities for rehabilitation identified. It is also necessary that the obligations of all participants should be identified (Republic, province, local self-government, operator, owner) for carrying out the rehabilitation process. All hazardous

waste generators that generate more than 200 kg/a year are obliged to prepare the waste management plans.

The collection and treatment of packaging waste polluted with hazardous substances should be carried out in compliance with the principles of hazardous waste treatment. The possibility and conditions under which the packaging waste polluted with hazardous substances could be burnt in cement plants as well (for example, waste packaging polluted with pesticides, chemical substances, etc.) should be taken into consideration.

7.3.3. Packaging waste

Materials used for the packaging must be produced and designed in the manner so that during their life-cycle they should meet the environmental requirements, safety and health requirements, health safety of packaged products, as well as the requirements regarding the transportation of products and waste management. Packaging waste generation should be reduced and it is necessary to provide for the potential re-use, to encourage recycling, as well as introduction of stimulation measures for the users of recycled packaging materials.

After determining the quantity of packaging waste generated in Serbia annually, it is necessary that the national objectives for reduction of packaging waste be determined and that the national plan for reducing packaging material waste be adopted. The Law governs the obligations and responsibilities of all subjects in packaging and packaging waste management (producers, importers, packer/fillers and delivering parties, as well as operators of the system for packaging waste management) in accordance with the "polluter pays" principle. The model of packaging and packaging waste management by which the system of returning, collection and refunding will be established, will be applied to the packaging and packaging waste management, which will result in the achievement of national objectives.

In the course of production and circulation of packaging, as well as when handling the packaging waste, national objectives determined by the plan must be taken into account thus referring to: volumes of packaging waste that must be re-used; quantities of raw materials in the packaging waste that must be recycled, within the quantities of processed packaging waste; quantities of certain materials in total mass of recyclable materials contained in packaging waste that must be recycled. The operator of packaging waste management plant is obliged to organise collection points for packaging waste, to ensure that the packaging waste he takes over or collects during each calendar year is re-used, recycled or disposed until the end of the next calendar year at latest, so that the national objectives could be achieved.

The model of voluntary agreement should be introduced as a modern instrument of formal understanding between the Government and all stakeholders and partners, in view of achieving national objectives. In the first place this refers to the manner of achieving national objectives, and/or quotas for return of all types of packaging waste in accordance with the best practices of the EU member states. In accordance with the Law on Packaging and Packaging Waste, it is necessary that the Government adopts the Plan for the reduction of packaging waste by which the objectives of collection and treatment of packaging waste will be determined as annual national objectives for the period of five years. The Agency should also establish and maintain the database on

packaging and packaging waste management, based on the reports of producers, importers, packer/fillers and suppliers of packaging, as well as the operators of the packaging waste management system.

7.3.4. Used batteries and accumulators

Trade in batteries and accumulators containing heavy metals is prohibited. Landfilling of used batteries and accumulators is prohibited, as well as their burning. Collection points for these should be determined, and the consumers should be encouraged to deliver used batteries and accumulators to these points, while the households are obliged to collect used batteries and accumulators and separate them from municipal and other types of waste. Labelling of batteries and accumulators must be implemented by using labels that include instructions and warnings for separate collection, contents of heavy metals, possibility of recycling or disposal, etc. Upon the establishment of the system for management of used batteries and accumulators, the objective is that the collection rate of at least 25% should be achieved by 2012, and the rate of at least 45% by 2016. With respect to economic instruments, the payment of fees must be introduced for producers and importers of batteries and accumulators that become waste upon their use. This fee will be used for collection and treatment of such waste. A person that conducts collection, storing and treatment of used batteries and accumulators must have a permit, must also maintain and keep records on used batteries and accumulators and the collected, stored and treated quantities, and must report relevant data to the Agency.

7.3.5. Waste oils

Waste oils must not be discharged to soil, surface and ground waters and sewage system. Also, mixing of waste oils during their collection and storing with substances containing halogen, polychlorinated biphenyls, polychlorinated terphenyls or pentachlorophenol is prohibited, as well as mixing with substances that are not waste oils, or mixing with hazardous waste. Reception points for waste oils collection should be established, as well as the collection and treatment system. Preconditions must be established for a retailer who sells oils for motor vehicles to provide conditions in the sales outlet for taking over waste oils from end-users who purchase motor oils from him; a retailer must keep them until they are taken over by a collector, in compliance with environmental protection. Waste oils treatment processes for re-use (regeneration and re-refinement) are advantageous with respect to energy recovery or other appropriate treatment processes. The treatment of waste oils and/or waste edible oils may be conducted only in treatment plants in the manner that will not endanger the environment and human health. Fees should be introduced for producers and importers of fresh oil that becomes waste oil after use. The fee will be used for collection and treatment of waste oils. The person that conducts collection, storing and treatment of waste oils must have a permit, must also maintain and keep records on waste oils and the collected, stored and treated quantities and must report relevant data in relation to final disposal of remained quantities after treatment to the Agency.

7.3.6. Waste tyres

Waste tyres must be treated, whereat recycling has advantage over burning. A special fee should be introduced for import and production of tyres for vehicles when they become waste tyres after use, to enable the establishment of the collection and treatment system. A network of buyout centres for waste tyres should be established. Legal or private entity that conducts the collection, transportation, treatment and disposal of waste tyres must have a permit, must also maintain and keep records on quantities of collected and treated waste tyres and report the data to the Agency.

7.3.7. End-of-life vehicles

It is necessary to adopt a bylaw which will provide for end-of-life vehicles management and for the conditions for storages and treatment plants of this waste, which includes obligations with respect to dismantling vehicles and separation of hazardous materials and components for further treatment before disposal. A producer of vehicles and spare parts or equipment for vehicles must limit the use of hazardous materials in vehicles and reduce their quantity to the greatest possible extent for the purpose of reducing environmental pollution, increasing the potential for re-use and recycling. The operator of the end-of-life vehicles treatment plant must ensure the treatment of such vehicles and disposal of parts that may not be processed, to issue to the owner or person collecting end-of-life vehicles a certificate on taking over the vehicle and submit the certificate on dismantling the end-of-life vehicle to the authority in charge of vehicles registration. With respect to economic instruments, the payment of fee should be introduced for producers and importers of vehicles that become waste after use. This fee will be used for collecting and treatment of this waste. The operator must keep records on quantities and treatment of vehicles he has taken over and report the data to the Agency.

7.3.8. Waste electric and electronic equipment

The system for separate collection of electrical and electronic products should be established so that the usable parts could be recycled. The waste components of electronic and electrical products containing PCB must be separated and their appropriate disposal must be ensured. It is necessary that a separate recovery of refrigerants should be established. Also, the remaining gas from electrical devices using gas must be collected. The permit is issued for collection, treatment and disposal of waste electric and electronic products, and the operator must keep records on the quantity and type of collected electric or electronic products and report the data to Agency. The fee should be introduced for producers and importers of electrical and electronic products that become waste after use. This fee will be used for collection and treatment of this type of waste.

7.3.9. Waste fluorescent tubes containing mercury

Waste fluorescent tubes containing mercury must be collected separately and treated before disposal. They could be treated only by a person holding a permit for this type of activity. The Law prescribes the procedure for managing waste fluorescent tubes containing mercury. The person that conducts collection, storage and treatment of fluorescent tubes must have a permit, must also keep records on fluorescent tubes and the collected, stored and treated quantities and must report such data to the Agency.

7.3.10. Waste contaminated with POPs (POPs waste)

The National Plan for the Implementation of Stockholm Convention, within which the action plans for PCB waste, waste pesticides and unintentionally released chemicals (dioxins and furans) have been prepared. It is necessary that the owners of POPs waste report the type and quantity of this waste to the ministry in charge of environmental protection. Appropriate storages for collection of PCB waste and equipment contaminated with PCB should be established. It is also necessary to establish storages for temporary collection of waste pesticides in regions, until their collection in regional storages for hazardous waste or actual treatment is provided for. Sites contaminated with POPs should be identified and the monitoring of POPs in the environment should be introduced. It is very important to work on public awareness raising and education about POPs waste and its treatment in general. The Agency keeps records on the devices in use containing PCB. The person that conducts collection, storage and treatment of PCB waste must have a permit, must also keep records on PCB waste and the collected, stored and treated quantities and to report such data to the Agency.

7.3.11. Medical waste

It is necessary to apply further implementation of the initiated process for mandatory sorting of medical waste at source, distinguishing between hazardous and non-hazardous ones. All healthcare institutions must adopt the plans for waste management and designate a person responsible for waste management. After the provisional solution by treating the infectious medical waste through disinfection and sterilisation and then by crushing and landfilling, the plant for thermal treatment of this waste – incinerator should be established, which is included in the long-term plan within the Central hazardous and medical waste treatment plant. The Agency collects data on waste from healthcare institutions in accordance with the rules for submitting data for the register of pollution sources.

7.3.12. Animal waste

Animal waste management falls under the competence of the Ministry of Agriculture, Forestry and Water Management. It is necessary to adopt new bylaws on animal waste management on the basis of the Law on Veterinary Services, harmonised with the European regulations.

Animal waste management programme should be developed. Animal waste, as well as products generated in processing of animal waste should be used for energy recovery. Taking into account poor equipment in the existing animal waste treatment plants of open type, it is necessary to perform their urgent reconstruction. Lack of a facility for collection and storing of animal waste is an additional problem which should be solved in collaboration with local self-government units, which are responsible for removal of animal carcasses from public areas and facilities for animal breeding. The Agency shall compile data about animal waste in compliance with the rules pertaining to submission of data to the polluter register.

7.3.13. Agricultural waste

Agricultural waste generation should be reduced by introducing cleaner production and BAT and BEP in food industry. Agricultural waste, i.e. biomass as side product from agricultural production, crop farming products, as well as production of industrial and other plants should be used for obtaining liquid fuels (biodiesel). Serbia has enough potential for the aforementioned. The use of wood waste should be improved in wood processing in the plants. On the basis of current utilization of forest potential, harvesting and wood processing, the total annual energy potential of different types of wood remains, together with the registered consumption of heating wood, amounts to about 1.02 million toe.

The existing plants for anaerobic digestion should be reconstructed and new ones constructed – for the production of biogas – plants for composting should also be constructed. Polluters shall submit data about this type of waste to the Agency.

7.3.14. Sludge from WWTP facilities

Sludge from WWTP facilities will be an additional load for landfills, when the percentage of treated municipal waters increases, and/or once the WWT plants and facilities are constructed. This sludge must be managed in accordance with the EU regulations. The sludge generated in the said facilities may reach about 500,000 t p.a., while filter cake may amount to 150,000 t p.a., although these are only estimates. Handling with the stabilised sludge generated in WWTPs shall be the following: use in agriculture, thermal treatment in incinerators, fuel in cement plants, disposal. The Agency shall collect data on quantities of this waste.

7.3.15. Construction and demolition waste

Uncontrolled disposal of construction waste in the environment should be prevented. Construction waste must not be disposed in the sites where such waste has been generated, nor can it be disposed in locations not particularly stipulated for such purposes. The owner of the construction waste shall bear costs for waste management and shall provide for conditions for separate collection and temporary storing of construction waste. Local self-government units should establish locations for disposal of construction waste through relevant planning documents. Funding and maintenance of locations shall be provided from fees for transportation and disposal collected from the owner of construction waste. Mandatory recycling of construction waste must be introduced in stationary and mobile plants. Demolition waste shall be separated and treated in compliance with law (paper, glass and plastics should be separated from construction waste and delivered to persons that collect and treat such materials). Concrete, asphalt, stone, etc. may be recycled.

7.3.16. Asbestos-containing waste

Asbestos-containing waste is a specific category and shall be separately collected, packed, stored and disposed, and the data about that shall be submitted to the Agency. Asbestos-containing waste shall be prepared for transportation and disposal by applying surface hardening or solidification or by destroying the asbestos fibres, in order to prevent release and distribution of asbestos fibres in the environment. Weakly bound

asbestos waste must be packed in appropriate non-permeable certified packaging. Before the disposal, this waste must be treated, packed and covered in the manner to prevent the release of asbestos fibres or dust in the air, and to prevent discharge of asbestos-containing liquids. Asbestos waste may be landfilled with non-hazardous waste without a previous analysis of eluate if its origin is known, and provided the following: it contains no other hazardous substances other than firmly bound asbestos; it includes construction waste containing firmly bound asbestos waste, disposed in separate cassettes for asbestos waste, separately from the other waste in the landfill. The cassettes containing asbestos waste must not be opened in order to prevent the release of asbestos fibres and dust into the environment.

7.3.17. Waste generated in mineral raw materials exploitation and in energy sector

The management of waste generated in exploitation of mineral raw materials and energy production shall be the competence of the Ministry of Mining and Energy. The principle of cleaner production must be introduced in the production during the exploitation of raw materials, as well as BAT and BEP. Use of waste generated in mining activities must be promoted and developed. It is necessary to recultivate the existing landfills for flying ash generated in combustion of coal in TPPs, and that ash should be used in road construction, civil engineering and production of construction materials, where such activities are justified and possible. New technology for preparation, transport and disposal of ash from thermal power plants in proportion 1:1 is currently under preparation. The Agency shall collect data on the quantities of this waste.

7.3.18. Waste generated in titanium-dioxide industry

Titanium-dioxide waste and the remains after the treatment of this kind of waste shall be disposed in the prescribed manner. Disposal operations are conducted by waste generator and owner, who implements the measures of supervision over the disposal operations and control of soil, water and air in the location of where the waste was used, stored or disposed. The generator and owner shall have the permit, shall keep records on this type waste and on the collected, stored and treated quantities, and shall report to the Agency the relevant data.

8. STRATEGIC FRAMEWORK FOR WASTE MANAGEMENT

8.1. Legal framework harmonised with the EU legislation

The Law **on** Waste Management is based on the basic principles of waste management and provides conditions for the full harmonization with the EU legislation. In order to regulate this area to the full extent, it shall be necessary to enact all bylaws and executive regulations which govern organization of waste management, i.e. it shall be necessary to implement further harmonisation of national regulations with the EU legislation and to develop and strengthen institutional capacities (the Ministry and other competent ministries, the Agency, the Fund, competent secretariats and services within the local self-governments).

It shall be necessary to pass new Rulebook on landfills, harmonised with the EU legislation, which would regulate technical and technological requirements for landfills, storages, transfer stations etc., as well as conditions for waste disposal, terms and measures pertaining to planning of landfills, their constructing and closing down. The requirements from the Directives 2008/98/EC and 2006/12/EC on waste should be fully transposed into the executive regulations, as well as the requirements from the Directive 99/31/EC on landfills and the instructions from the technical guidelines from the Basel Convention on landfills.

The requirements from the Directive 91/689/EEC on hazardous waste (supplemented by the Directive 94/31/EEC) should be fully transposed into bylaws, as well as requirements from the Directive 67/548/EEC on classification, labelling and packing of substances and mixtures (supplemented 2006/121/EC) and the Directive 2000/76/EC waste incineration and the instructions form the technical guidelines of the Basel Convention on incineration.

Packaging waste shall be regulated by the Law on Packaging and Packaging Waste. The requirements from the Directive 94/62/EC and 2004/12/EC pertaining to the establishment of an organisation to manage packaging and packaging waste need to be fully transposed into the executive regulations, as well as the requirements from the Decision of the Commission 2001/171/EC on the conditions for reduction of heavy metals concentration in glass packaging, the Decision of the Commission 1999/177/EC on the conditions for reduction of heavy metals concentration in the plastic crates and pallets and the Decision of the Commission 97/129/EC on establishment of the system for identification of packaging materials. It shall also be necessary to adopt bylaws on reporting on the management of packaging and packaging waste and chemical packaging waste management, which shall provide for full harmonisation in terms of the requirements contained in the following EU regulations: Directive 94/62/EC, Decision of the Commission 2005/270/EC on establishing patterns regarding the databases from the Directive 94/62/EC, as well as the Decision of the Commission 97/622/EC on questionnaires for the member states on the implementation of certain Directives in the waste sector.

The requirements contained in the Directive 91/157/EEC an batteries and accumulators should be transposed into a bylaw which governs management of waste batteries and accumulators.

The requirements contained in the Directive 75/439/EEC on disposal of waste oils need to be transposed into a regulation that would govern the conditions, manner and procedure for management of waste oils.

The Rulebook on waste tyres, compliant with the technical guidelines of the Basel Convention for identification and management of waste tyres and requirements contained in the Directive 2006/12/EC on waste, Directive 99/31/EC on landfills, Directive 2000/76/EC on waste incineration, Directive 2000/53/EC on end-of-life vehicles has been adopted.

It shall be necessary to legally regulate management of end-of-life vehicles in conformity with the Directive 2000/53/EC on end-of-life vehicles.

The requirements contained in the Directive 2002/95/EC and Directive 2002/96/EC need to be transposed into an executive regulation which would govern the list of electric and electronic products, the manner and procedure for management of waste electric and electronic products.

The requirements contained in the Directive 2002/95/EC and the Directive 2002/96/EC should be introduced into the regulation which shall govern the manner and procedure for management of waste fluorescent tubes containing mercury.

The requirements from the Regulation 850/2004/EC on persistent organic pollutants, technical guidelines of the Basel Convention and the Stockholm Convention need to be fully transposed into the executive regulation.

Bylaw that regulates separation, collection, transport, treatment and disposal of medical waste will be passed by the ministers of health and environment, in compliance with the Directive 2008/98/EC on waste, Directive 91/689/EEC on hazardous waste and Directive 99/31/EC on landfills. This regulation shall regulate the manner and contents of the waste management plan, medical and pharmaceutical waste management, as well as the list of pharmacies that shall accept useless medications from the citizens.

It is necessary to speed up the enactment of the Law on Waters and regulations which shall regulate the treatment of municipal wastewaters in conformity with the Directive on the of municipal wastewaters treatment 91/271/EEC.

In accordance with the Law on Waste Management and in compliance with the Directive 87/217/EEC on prevention and reduction of environment pollution with asbestos, it shall be necessary to enact a regulation that would govern the manner of packaging, criteria, conditions and manner for final disposal of asbestos-containing waste and other measures to prevent spreading of asbestos fibres and dust in the environment.

It shall be necessary to adopt amendments to the Law on Mining in order to harmonize it with the Directive 2006/21/EC on management of waste from the mining industry, which supplements the Directive 2004/35/EC.

It shall be necessary to adopt a bylaw to regulate the manner and procedure for titanium dioxide waste management, as well as measures for supervision and monitoring of environment at the location in compliance with the Directive 78/176/EEC on waste form titanium dioxide industry.

8.1.1. Liabilities and obligations of parties participating in waste management

New Law on Waste Management has established liabilities and obligations for all parties participating in waste management: waste generators, i.e. waste owners, waste carriers, operators in plants for storage of waste, waste treatment and landfill operators.

Waste generator shall do the following: draft a waste management plan, if they produce more than 100 t of non-hazardous waste annually, or more than 200 kg of hazardous waste, acquire a report on inspection of waste, apply the hierarchy principle in waste management, as well as prescribed measures in handling the waste during the collection, storage or handover of waste, etc.

Waste owner shall be obliged to apply the prescribed measures for handling the waste during the collection, storage or handover of waste, and to bear the costs of waste management including the costs of handing over the waste to the collector or the plant for treatment or disposal of waste. The ownership of waste ceases when the new owner has taken over the waste and received the Document on movement of waste.

Waste carrier shall be obliged to carry out the transportation of waste in conformity with the obtained permit and the requirements regulated by specific transport regulations.

Operator in the storage plant shall be obliged to perform his activities in conformity with the permit, and to keep records of the stored waste in places which are technically equipped for temporary storage of waste in the locations provided by the waste producer or the waste owner, in collection centres, transfer stations and other locations.

Operator in the plant for treatment and disposal of waste shall be obliged to do the following: carry out his activities in conformity with the permit, draft a working plan for the plant for treatment and/or disposal and provide for its implementation, publish a list of waste he is authorized to treat, manage the equipment and the plant for waste treatment, secure the waste and protect it from spreading and leaking, maintain records of the waste he treats or disposes, charge for services of waste treatment or disposal, designate a qualified responsible person, provide for recultivation of the landfill after its closure and competent supervision of the landfill after its closure in the time period of at least 30 years.

8.1.2. Waste management permits

One or more types of activities within the area of waste management shall be allowed through a **permit to perform waste management activities,** specifically: waste collection, waste transport, waste storage, waste treatment and waste disposal. One permit can be issued for several of the above mentioned activities. These permits are issued to carry out activities for which an integrated permit is not to be issued according to the law.

The Ministry shall issue the following permits: permits to collect, transport, store, treat and dispose of hazardous waste, permit to treat inert and non-hazardous waste by incineration and permit to treat waste within a mobile plant; permits to store, treat and dispose inert and non-hazardous waste on the territory of several local self-government units.

The competent autonomous province authority shall issue the following: permits to store, treat and dispose of inert and non-hazardous waste on the territory of several local self-government units within the autonomous province; permits to collect, transport, store, treat and dispose of waste for all plants for which the operation permit is issued by the competent authority of the autonomous province.

The city, i.e. the city of Belgrade, shall issue permits to collect, transport, store, treat and dispose of inert and non-hazardous waste on its territory.

Local self-government unit shall issue the following: permits to collect and transport inert and non-hazardous waste on its territory and permits to temporarily store inert and non-hazardous waste in the location provided by the waste generator and/or owner.

The permit shall establish the conditions for performing the activities of the operator in the plant for storage, treatment and disposal of waste. Permit shall not be issued for movements of waste within the waste generator's location, containers for household waste in public places, places in which less than 10 t of inert waste is stored, places in which less than 2 t of non-hazardous waste is stored.

The regulations on **management of packaging and packaging waste** envisage that the ministry competent for the environment protection should issue the following**:**

- permit to perform self-packaging waste management – to the producer, importer, packer/filler and the deliverer that collects the packaging waste on its own (except for the municipal waste) for end users, providing for its reuse, recycling and disposal;
- permit to manage packaging waste – to the operator of the plant registered to carry out activities of collection, transport, reuse, recycling or disposal of waste who owns the equipment, plants and devices for management of packaging waste, or they are owned by his contractor.

8.1.3. Document on waste movement

The Document on waste movement tracks the movements of non-hazardous (except for household waste) and inert waste, while the **Document on hazardous waste movement** tracks the movements of hazardous waste. The Document on waste movement, as well as the Document on hazardous waste movement, shall be filled out and signed by the following: waste generator, and/or owner, carrier and the party that receives the waste. In addition to the basic information on the name, address etc. of the said participants in the waste movements, the contents of this document shall also include data on the type of waste, its classification, hazardous characteristics, weight, type of packaging, mode of transportation, destination, special notes or handling information, type of means of transportation, its route, plant for treatment or disposal, permits. The receiving party, i.e. operator of the plant for treatment or disposal of waste returns the filled in form of this document to the waste generator, and/or owner.

In case of hazardous waste movement, the hazardous waste generator and/or owner, having filled in the document, and before starting the movement, shall deliver a copy of the document to the competent authority, as a prior information. Also, the owner and/or the operator of the plant for treatment or disposal of hazardous waste, shall deliver to the competent authority the copy of the filled in document, after the reception of the hazardous waste.

8.1.4. Waste management plans

In order to plan waste management, in addition to the Waste Management Strategy, it shall be necessary to enact waste management plans.

National plans for specific waste streams shall be enacted in order to manage various waste streams.

Regional waste management plan shall be enacted by local assemblies of two or more local self-government units by which they define their joint objectives in waste management. The procedure of drafting and enacting a regional plan shall be governed by the agreement entered into between the assemblies of local self-government units.

Local waste management plan shall be enacted by local self-government unit by which it defines the objectives of waste management on its territory.

Two or more local self-government units can jointly determine a location for construction of a waste management plant on their territory. When determining the location for waste management plant, the following shall be taken into consideration: quantity and type of waste, planned manner of storage, treatment or disposal, geological and other properties of the land and the micro-climate characteristics of the area and vicinity of protected natural goods and landscape properties.

Waste management plan in IPPC establishments shall be drafted by the operators of those establishments, as a part of the documentation which is attached to the application for integrated permit, and shall contain the following: documentation on the generated waste, measures that are taken to reduce waste generation, particularly hazardous waste, manner of storing, treating and disposing of waste, measures for environmental protection and protection of human health, etc.

Operational plan for waste management plants shall be drafted by the operators of waste management plants for which integrated permit or waste management permit is issued and shall contain the following: description of the location, plant equipment, infrastructure of the location, operations in the plant etc.

Operational plan for landfills shall also contain elements pertaining to the equipment of the location, with purpose to prevent and control pollution, such as: system for wastewaters reception, system for leachate water reception, system for leachate water treatment, system for landfill gas control, system for the collection of atmospheric waters, and establishment, maintenance and protection of the finishing cover.

8.2. Institutional framework for waste management

The institutional framework for waste management shall pertain to the institutional structures and arrangements for waste management, as well as organizational procedures and the capacities of the competent institutions, and shall include the following:

- division of functions and responsibilities among the local, regional and republic authorities and organizations, as well as in urban areas with several municipalities;
- organizational structure of the institutions responsible for waste management, including the coordination between them and other sectors and/or management functions;
- procedures and methods used for planning and management;
- capacities of the institutions responsible for waste management and the capacities of the employees;
- inclusion of the private sector and participation of interested parties.

8.2.1. Decentralisation and division of responsibilities

In order to implement the National Waste Management Strategy, it shall be necessary to strengthen the capacities and the position of the Fund. In the forthcoming period, it shall be necessary to carry out adjustment of the systematization to the new role of the Fund, as well as employment for all workplaces, in order to enable adequate response to new tasks.

Effective waste management depends on the adequate division of responsibilities, competences and revenues between the central, regional and local governments, as well as within the urban municipalities. Local authorities, responsible for municipal waste management, shall manage all the operations concerning the waste, especially collection and investment of the collected fees and other revenues into the municipal waste management. Decentralisation of authority is followed by an adequate distribution of financial and administrative responsibilities and capacities for planning, implementation and functioning of the system. This requires better preparation of local budgets for the municipal waste management, based on real costs. Decentralization makes waste management more flexible, efficient and responsible in respect of the local requirements. At the same time, the delegation of decision-making, finance management, provision and implementation of the function at the lower levels, reduces the burden on the Ministry, and enables it to focus on its own competences.

Hazardous waste management shall be responsibility of the Republic and the province, and they are obliged to provide programmes and plans, as well as legal prerequisites for the proper handling with hazardous waste. Provincial authorities will also have certain responsibilities in the area of preparation and implementation of programmes and plans at the provincial level.

Bearing in mind the different competences over certain waste streams (medical, agricultural, mineral raw materials, pesticides etc.), maximum cooperation shall be necessary between the competent ministries, in order to manage individual waste streams adequately. It is expected that full cooperation in hazardous waste management will be established between the local self-governments and the Republic, and/or the province.

Decentralization and development of the waste management capacities normally requires innovations in organizational structures, human resources planning and defining the tasks of the responsible local government services. On the other hand, association

of municipalities shall be necessary in order to plan waste management jointly with the purpose to establish an economically sustainable and rational system.

8.2.2. Planning and management methods

The approach to management, methods and techniques used in management of municipal waste are often inadequate. On the basis of the defined role of the local authorities in the municipal waste management, it shall be necessary to establish strategic planning and financial management, including the economic prices of services, planning and control of the budget, calculation of unit costs and financial and economic analysis. For the operational planning, the local authorities shall be obliged to provide collection of data, analysis of waste composition, assessment of waste generation, modelling, specification of necessary equipment, provision of monitoring, evaluation and planning auditing.

The basic strategic objectives shall be the following:

- harmonisation of the national waste management legislation with the EU regulations;
- establishing institutional organization with purpose of reaching harmonization with the EU /national requirements;
- efficient implementation of regulations;
- adequate human resources and capacities for waste management (public and private sector);
- development of awareness of the waste management issues.

Planning of spatial development has a very important role in achieving a sustainable waste management with the following purpose:

- to provide plan framework which would enable establishment of waste management system;
- to encourage the practice of waste management with the purpose to conserve environmental quality;
- to protect certain areas and natural values from unplanned development;
- to minimise adverse impacts on the environment arising from handling, transportation, treatment and disposal of waste;
- to consider the need for new plants for waste treatment and/or disposal.

Regional planning has the key role in waste management, considering the fact that the waste generation and possibilities for treatment or disposal do not occur uniformly in the region. Development of local waste management plans within the local self-governments in conformity with the National Strategy provides decentralisation and development of a local waste management system.

8.2.3. Inclusion of private sector

Participation of the private sector is of a high priority of the Government of the Republic of Serbia. In order to develop competition between the public and the private sector, the Government needs to take necessary institutional/organisational measures and actions. Private commercial entities can provide the services of collection, transportation and

disposal of municipal waste more efficiently, and often also with less costs than the public sector. Private commercial entities can be interested in providing services of managing specific waste streams. Also, private sector can be interested in introducing the technologies of treating certain types of hazardous and non-hazardous waste. However, the inclusion of private sector in waste management does not guarantee the efficiency per se. It shall be necessary to organise a competitive tender for provision of services and efficient supervision of the contract and the provision of services.

It shall be necessary to introduce incentive measures for the participation of the private sector in all domains of managing municipal and hazardous waste and to work on the development of partnership between the public and the private sector, as well as to stimulate the existing and develop new recycling industry.

8.3. Technical aspects

8.3.1. Infrastructure for municipal waste management

The Strategy envisages foundation of regional waste management centres. The association of municipalities with purpose of joint waste management will establish a system of regional centres which will include a regional landfill for the municipal waste, a plant for the separation of the recyclable waste, transfer stations, as well as composting plants, which all make an infrastructure for the municipal waste management. In the cities, it shall be necessary to establish locations for the centres for separate collection of recyclable waste, where the citizens themselves would bring their waste. The regional waste management plans will precisely define waste management in conformity with the EU Directives and guidelines from the National Waste Management Strategy. Potential locations for regional waste management centres, criteria and guidelines for their foundation shall be planned through spatial plans, while the definite locations will be selected after the investigation works and carrying out the procedure of environmental impact assessment. It is of particular importance to pass new criteria for evaluation and choice of landfill locations in conformity with the EU Directive 99/31/EC on landfills, as the current rulebook is out-of-date. The design studies for landfills must be harmonized with the EU Directive on landfills. The basic objectives in the development of the regional concept of waste management shall be rational use of space as a resource and reduction in costs of waste management. This proposal does not exclude other modes of association, which would be definitely established after the signing of inter-municipal agreements and enactment of regional waste management plans.

Regional landfills are landfills for non- hazardous waste. A landfill for inert waste can also be built within the centre and in conformity with the standards. Only the following can be disposed at a non-hazardous landfill:

- municipal waste after separation;
- non-hazardous waste of any origin which meets the criteria for the acceptance of waste into the landfill for non-hazardous waste;
- stabilised and non-reactive, pre-treated hazardous waste, if the limit values of polluting materials in the eluate do not exceed the limit values for non-hazardous waste.

A landfill shall be equipped with a system for landfill gases capture. If the utilisation of gases is not economic, it should be burnt onsite. A regional landfill, among other elements, shall have a plant for leachate waters treatment.

Plant for separation of recyclable waste shall be situated in the area near the landfill. A technological line for automatic or manual separation of waste shall be installed. The separated recyclable materials are baled or pressed and transported further on to the plants which recycle that type of waste.

Plant for composting or anaerobic digestion can include the complete mechanical and biological treatment of waste, or just aerobic treatment of waste in the plant or in the compost field situated near the landfill.

Transfer stations shall be places for temporary storage, preparation and reload of waste intended for transport into the regional waste management centre. Having in mind the concept of waste management in the Republic of Serbia, the waste stream also includes its passage through the transfer station. The transfer station shall be the place where the municipal waste is unloaded from the waste collection vehicles, inspected with optional separation of bulky waste, shortly retained, loaded into bigger vehicles and transported for further treatment into the regional centre. It is desirable to carry out the reload directly from the collection vehicle into the transport vehicle, which secures full environmental protection. Transport of waste by a higher-capacity vehicle significantly reduces the long-distance transfer costs. The transfer stations will be determined within the regional waste management plans. Also, locations of the existing municipal waste disposal sites can be used as transfer stations, but they have to be previously rehabilitated according to the approved rehabilitation projects.

Centres for separate collection of recyclable waste shall be places intended for separation and temporary storage of specific types of waste. These centres have a significant role in the overall waste management system, because they serve as a connection between the local self-government unit and the citizens, authorized collectors and the persons in charge of treatment. The locations for the establishment of the centres in which the activities on the separated collection of waste are carried out should be provided by the local self-government units.

Primary waste selection shall be introduced gradually. A constant campaign is needed, as well as education of citizens on the necessity and the importance of primary selection.

Table 8.1. Planned network of regional municipal waste management centres

	Local self-government unit, leader of the activities of regional municipal waste management centre establishment	**Other municipalities that make a Regional municipal waste management centre**	**Number of inhabitants (2002)**	**Waste qty, t/yr (2009)**
1.	**Sombor**	Apatin, Kula, Odžaci, Bač	230.252	59.914
2.	**Subotica**	Bačka Topola, Kanjiža, Mali	266.193	86.749

		Iđoš, Senta, Novi Kneževac, Čoka		
3.	**Novi Sad**	Bačka Palanka, Bački Petrovac, Beočin, Žabalj, Vrbas, Srbobran, Temerin	510.522	192.226
4.	**Kikinda** **Novi Bečej**	Ada, Žitište, Nova Crnja, Bečej	200.843	46.826
5.	**Pančevo**	Opovo	138.178	54.927
6.	**Vršac**	Bela Crkva, Alibunar, Plandište	111.067	33.771
7.	**Zrenjanin**	Sečanj, Kovačica, Titel	193.368	67.512
8.	**Inđija**	Irig, Ruma, Sremski Karlovci, Pećinci, Stara Pazova	211.026	74.305
9.	**Sremska Mitrovica**	Šabac, Šid, Mali Zvornik, Loznica, Bogatić, Krupanj	397.249	85.036
10.	**Beograd**	Voždovac, Vračar, Grocka, Zvezdara, Zemun, Mladenovac, Novi Beograd, Palilula, Rakovica, Savski venac, Sopot, Stari grad, Surčin, Čukarica	1421.997	796.318
11.	**Valjevo**	Ub, Osečina, Lajkovac, Mionica, Ljig, Koceljeva, Vladimirci, Barajevo, Lazarevac, Obrenovac	382.340	88.075
12.	**Smederevo**	Požarevac, Kovin, Veliko Gradište, Golubac	250.772	63.660
13.	**Petrovac**	Malo Crniće, Žabari, Kučevo, Žagubica	90.979	9.300
14.	**Lapovo**	Velika Plana, Smederevska Palanka, Rača, Despotovac, Batočina, Svilajnac	179.013	37.700
15.	**Kragujevac**	Aranđelovac, Topola, Gornji Milanovac, Knić	319.188	86.653
16.	**Jagodina**	Paraćin, Ćuprija	160.087	44.117
17.	**Užice**	Bajina Bašta, Požega, Arilje, Ivanjica, Čajetina, Kosjerić, Čačak, Lučani, Ljubovija	378.668	91.516
18.	**Nova Varoš**	Priboj, Prijepolje, Sjenica	116.189	19.452
19.	**Zaječar**	Bor, Negotin, Majdanpek, Kladovo, Knjaževac, Boljevac, Sokobanja	271.465	31.819
20.	**Pirot**	Dimitrovgrad, Bela Palanka, Babušnica	100.133	21.617
21.	**Kraljevo**	Vrnjačka Banja, Novi Pazar, Raška, Tutin	296.761	57.077

22.	**Kruševac**	Trstenik, Varvarin, Rekovac, Ćićevac, Brus, Aleksandrovac	263.740	54.595
23.	**Niš**	Gadžin Han, Svrljig, Ražanj, Doljevac, Aleksinac, Merošina	363.851	91.374
24.	**Prokuplje**	Žitorađa, Kuršumlija, Blace	98.250	18.044
25.	**Vranje**	Preševo, Bujanovac, Trgovište, Vladičin Han, Surdulica, Bosilegrad	229.596	49.968
26.	**Leskovac**	Lebane, Bojnik, Medveđa, Vlasotince, Crna Trava	234.018	55.889

Note: Local self-government unit, the leader of the activities of the regional municipal waste management centre establishment, does not have to be the municipality/city to provide the area for construction of the regional municipal waste management centre.

Table 8.1 has been made on the basis of available information as of March 2010, and is a proposal for the establishment of the regional municipal waste management centres. In compliance with the Law on Waste Management, obligations of local self-government units have been defined, specifically:

- local self-government unit shall organise and implement municipal (inert and non-hazardous) waste at its territory;
- local self-government unit shall adopt local waste management plan and shall provide for conditions for its implementation;
- two or more local self-government units may manage waste jointly, if that is of their joint interest, under conditions provided in law and through inter-municipal agreement entered into between local self-government assemblies, which shall regulate mutual rights and duties in providing the conditions for functioning and operation of waste management plant at the territories of those local self-government units. This agreement shall also define rights and duties of the utility company, or other legal or private entity that performs the above activities, decision-making process in the case of disagreement between local self-government units about certain issues related to waste management activities, as well as other issues of importance for the organisation and implementation of waste management;
- in agreement with one or more local self-government units, the local self-government unit shall determine the location for construction and operation of the facility for storage, treatment or disposal of waste at its territory;
- joint self-government units shall develop a Regional waste management plan. The Regional waste management plan shall define joint objectives in waste management and shall be adopted by the assemblies of two or more local self-government units with at least 200,000 inhabitants living at their territory, with the Ministry's consent. The Regional waste management plan can be adopted for municipalities with less than 200,000 inhabitants living at their territory upon previously elaborated feasibility study for the adoption of the regional plan to be adopted by the Ministry. The procedure for the drafting and adoption of the regional plan shall be regulated through the agreement entered into between the assemblies of local self-government units.

At the same time, it shall be necessary to work on the rehabilitation of the existing landfills – dumps that pose environmental risk. Rehabilitation of dump sites should be carried out in conformity with the adopted laws which are harmonised with the requirements of the EU Directives.

8.3.2. Infrastructure for hazardous waste management

Having in mind the existing data on generation of hazardous waste at the annual level and changes in the industry of the Republic of Serbia, it is planned to construct a National centre for physical-chemical treatment of hazardous waste.

As a part of the project "Technical assistance in preparation of documentation for the construction of the facility for physical-chemical treatment of hazardous waste", funded from the EU pre-accession funds – 2009 programme cycle, a feasibility study shall be develop to take into consideration several locations for construction of the facility for physical-chemical treatment of hazardous waste in Central Serbia, in the region that convers Moravički, Šumadijski, Pomoravski, Raški and Rasinski administrative county.

The capacity of the facility for physical-chemical treatment of hazardous waste of 43,000 t/yr covering the area of 20 ha has been planned based on the overall quantity of hazardous waste generated in the Republic of Serbia annually, which can be treated by physical-chemical processes – mainly waste of inorganic composition. It has been planned that this centre includes a landfill with cassettes for hazardous and non-hazardous waste.

Technical documentation needed for the construction of this facility, which shall also be developed through the mentioned project, shall precisely define appropriate technology, as well as technical-technological and exploitation characteristics of the facility, compliant with the international standards.

In addition to the facility for **physical-chemical treatment of hazardous waste,** it shall be necessary to establish **regional storages for hazardous waste,** intended for safe collection and maintenance of such waste until the application of treatment. In order to define potential locations for the construction of the mentioned storages, it shall be necessary to analyse the existing status in the area of hazardous waste management.

Construction of central regional storages for hazardous waste is planned for the following administrative counties:

- Srednjebanatski administrative county;

- Podunavski administrative county;

- Mačvanski administrative county;

- Moravički administrative county;

- Nišavski administrative county.

The regional storages of hazardous waste shall be specially planned places where generators can dispose of their hazardous waste.

In the cities, it shall be necessary to determine locations for the **centres for the collection of household hazardous waste** (waste oils, waste electric and electronic equipment, used batteries etc.). The centres for the collection of household hazardous waste will be organised as collection centres for the collection of batteries, accumulators, medications, stained packaging from paints and varnishes etc. These centres can be situated near the locations of the centres for separated collection of recyclable waste. Also, actions of collecting household hazardous waste should be periodically planned and mobile collection stations should be used as well.

Incineration plants for hazardous industrial waste, including medical and animal waste shall be considered in the forthcoming period in accordance with the needs and capacities of the existing facilities (cement plants, thermal power plants, heating plants, etc.).

Production capacities of the existing facilities with the option of thermal treatment of waste (cement plants, steel mills, thermal power plants), may be used for co-incineration of certain types of waste, if they meet all the requirements prescribed by legal regulation.

It shall be necessary to rehabilitate hot spots contaminated by hazardous waste – primarily locations in Bor and Pančevo, but also in other cities where such contamination has been recorded or where historical pollution will be recorded.

8.3.3. Infrastructure for medical waste management

Medical waste management system has been established through distribution of **78 autoclaves for low-temperature treatment of a part of medical waste and 78 crushers** (disinfection/sterilisation of infectious waste and sharp objects – crushing/grinding of sterilised waste) in 56 healthcare centres in the Republic of Serbia, which were provided by the European Union. A central point system for infectious medical waste treatment, with transport equipment, is the most efficient and effective way to manage medical waste at the whole territory of the Republic of Serbia. This concept shall meet international regulations and standards and shall lead towards the establishment and improvement of medical waste management system in the Republic of Serbia. After the construction of incinerator for medical waste treatment, infectious medical waste shall be incinerated in compliance with the requirements prescribed in the Directive 2000/76/EC. Autoclaves have been placed within clinical centres (Belgrade, Niš, Kragujevac and Novi Sad) and hospitals, which are the biggest generators of medical waste. Each county has at least one state-owned healthcare institution equipped with an autoclave, whereat such institution is a central point for infectious medical waste and it has the obligation to treat infectious waste from healthcare institutions of the county. In some counties, additional healthcare institutions have been identified as local points for infectious medical waste treatment.

Table 8.2. Network of central points for infectious medical waste treatment for the region territory

	Central point for infectious medical waste treatment for the region territory		Local point for infectious medical waste treatment for the region territory	Qty. of hazardous medical waste, t/yr
1.	General Hospital Subotica	1.	Clinical Centre of Vojvodina, Novi Sad	1.099
2.	General Hospital Sombor	2.	Institute for Pulmonary Diseases of Vojvodina, Sremska Kamenica	
3.	Institute for Public Health of Vojvodina, Novi Sad			
4.	General Hospital Zrenjanin	3.	General Hospital Kikinda	1.273
5.	General Hospital Senta	4.	General Hospital Vršac	
6.	General Hospital Pančevo	5.	Specialised Hospital for Pulmonary Diseases Bela Crkva	
7.	General Hospital Sremska Mitrovica			227
8.	Healthcare Institution Voždovac	6.	Clinical-Hospital Centre "Bežanijska kosa"	2.607
9.	Clinical Centre of Serbia	7.	Clinical-Hospital Centre "Dr Dragiša Mišović - Dedinje"	
10.	Institute for Public Health of Serbia "Dr Milan Jovanović Batut"	8.	Clinical-Hospital Centre "Zvezdara"	
...	...	9.	Clinical-Hospital Centre "Zemun"	
...	...	10.	Mother and Child's Healthcare Institute of Serbia "Dr Vukan Čupić"	
...	...	11.	Institute for Cardiovascular Illnesses "Dedinje"	
...	...	12.	Rehabilitation Clinic "Dr Miroslav Zotović"	
...	...	13.	Institute for Orthopaedic-Surgery Illnesses "Banjica"	
...	...	14.	Specialised Hospital for Internal Diseases Mladenovac	
11.	General Hospital Šabac	15.	Healthcare Centre Loznica	518
12.	Healthcare Centre Valjevo			
13.	Healthcare Centre Smederevo	16.	General Hospital "Stefan Visoki" Smederevska Palanka	350
14.	Healthcare Centre Požarevac	17.	Healthcare Centre Petrovac	
15.	Healthcare Institution	18.	Healthcare Centre Aranđelovac	794

	Kragujevac			
16.	Clinical Centre Kragujevac	19.	Healthcare Centre Paraćin	
17.	General Hospital Jagodina	20.	General Hospital Ćuprija	
18.	Healthcare Centre Čačak	21.	General Hospital Gornji Milanovac	
19.	General Hospital Prijepolje	22.	Healthcare Centre Užice	327
20.	Healthcare Centre Bor	23.	Healthcare Centre Kladovo	544
21.	Healthcare Centre Zaječar	24.	Healthcare Centre Negotin	
22.	Healthcare Centre Pirot	25.	Healthcare Centre Knjaževac	
		26.	Specialised Hospital for Pulmonary Diseases "Ozren", Sokobanja	
23.	Healthcare Centre Kraljevo	27.	Healthcare Centre Novi Pazar	583
24.	Healthcare Centre Kruševac			
25.	Healthcare Institution Niš			830
26.	Clinical Centre Niš			
27.	Healthcare Centre Prokuplje			
28.	General Hospital Leskovac			438
29.	Healthcare Centre Vranje			
	TOTAL			**9.560**

Source: National Guide for Safe Management of Medical Waste, Ministry of Health, 2009

According to the same principle, a network for collection and treatment of medical waste generated in veterinary organisations should be established, i.e. it is necessary to use capacities of 12 veterinary institutes and procure additional necessary equipment.

8.3.4. infrastructure for specific waste streams management

The construction of an infrastructure for specific waste streams management will be carried out through investments of the private sector, as well as through the use of available assets of the Fund, the Development Fund, and international funds, on the basis of permits for waste management and regions that will be defined after a precise analysis of waste quantities and after enactment of regulations on manners and procedures of collection, transportation, treatment and disposal of specific waste streams. The priority should be given to the development of construction waste recycling and reuse for construction purposes.

Locations for **landfills for disposal of inert waste** (such as the construction waste and demolition waste) should be determined.

8.4. Economic aspects

Economic aspects refer to overall national economy and they shall be related to the following:

- Effects of waste management services on productivity and economy development;
- Conservation and efficient use of materials and resources;
- Economic instruments;
- Restructuring and transformation of sectors;
- Private sector participation.

8.4.1. Economic productivity and development

Efficient and reliable waste management service is a base for the development of urban economy. The goals of decreasing the costs of the services may be contrary to the goals of environmental protection. In order to determine appropriate costs, it is important to provide reliable and complete information about the sources, quantities and composition of waste.

Demographic factor that will influence the increase of waste generation is further change of the population structure in the relation of urban/other settlements. The current share of urban population is 57 % and this figure is expected to increase in the future period, although with considerably lower intensity than it has been the case so far. Municipal waste generation as per capita is higher in urban households due to the consumption structure of the population and to larger proportion of accompanying generators of municipal waste (shops, offices, institutions, schools, restaurants etc.).

The next important issue is the ratio between economic development dynamics and waste generation. A correlation certainly exists, but it is the question of estimation, because comparisons with other countries show that such a ratio should not be high, and the unit waste generation as per domestic product in Serbia is currently very high. The quantities of waste generated in Serbia are at the level of 50 % of waste generation in highly developed countries of Europe, while its gross domestic product (GDP) is at the level of about 10 % of theirs.

8.4.2. Efficiency of resource utilisation

At the macroeconomic level, waste management begins with an efficient use of materials and avoidance of hazardous substances in the phase of production and distribution. Measures of a rational use of raw materials should be introduced, as well as reuse of waste. The most effective way of promoting an efficient use of resources is to show future costs of collection and disposal of waste, as well as costs of pollution that arise if waste is not collected in the phase of production, distribution and consumption in accordance with “polluter pays” principle. According to the new legal framework for waste management, manufacturers, importers and sellers will be obliged to take over used, waste products (refrigerators, batteries etc.) that will be recycled by collectors and persons who perform treatment of waste, and who will return to the market the raw materials obtained in this way.

The rise in service prices proportional to the increase of the quantity of generated waste influences the behaviour of consumers and the manners of disposal.

8.4.3. Economic instruments

At this moment, the only widespread economic instrument for waste management in Serbia is charging users for rendered services. Services that are charged are collection and disposal of municipal waste. Charges are mainly calculated per square metre of residential or business area. In practice, there are other criteria as well: per type of the residential building from which waste is taken out and, as far as business sector is concern, per area of actually used space, the location, as well as the character of business activities performed and the quantity of waste. The application of this well-known instrument has a long tradition related to municipal waste. Typically, the collection of charges is carried out by public utility companies that deal with collection, transportation and disposal of waste. Charges for households are collected monthly, whether through a consolidated system of collection of charges for utility services (most often with the collection of charges for water consumption), whether separately. In cities, the consolidated system of collection is commonly used, while the separate collection prevails in smaller places.

Within the current system, a deviation from the “polluter pays” principle is apparent. The prices of waste collection and disposal have been depressed for years. The first reason for that is of social nature: through these prices, the living standard of the population has been supported. The opinion that the price of utility services is a social category rather than economic one is erroneous. The second reason for low prices should be traced in the character of the ownership over public companies. The residential space criterion has been rejected nowadays in most European countries, even in the countries in transition. A particular problem today is a low degree of collection of service charges from the economy. Difficult financial situation, high internal indebtedness of companies and low liquidity, lead to a low degree of collection of charges for utility services that varies in certain municipalities from 10 % to 70 %.

The Republic of Serbia lacks a number of significant economic instruments for waste management. In order to improve the current situation in waste management, the existent system should be reorganised and new economic instruments should be introduced. The starting orientation is as follows:

- Maximum observance of the principle that the polluter is the one who bears the pollution costs;
- Formation of an efficient, reliable and coherent system of instruments.

The aim of this segment is to create such instruments that will support and practically implement the strategy based on the acceptance and application of EU standards related to waste management. The schedule of the Strategy realization, directed towards achieving the European standards as soon as possible, will depend primarily on general social and economic trends in Serbia, which will have effects on the activation of some economic instruments.

As far as changes of the current system are concerned, it is first necessary to change the criterion for determination of charges for utility services. Such charges should be determined according to a criterion that more realistically reflects the relation between the quantity of municipal waste and the costs of its disposal. These should be charges determined according to the mass or volume of generated waste. Considering the

economy sector, invoicing should also be done according to waste quantity, whether by volume, or by mass. By this, the “polluter pays” principle would be considerably observed.

The price of the services of municipal waste collection and disposal must be based on full costs, meaning that both variable and fixed costs must be taken into account. These prices must be subject to economic regulation since municipal services show the characteristics of natural monopoly. On the other hand, considering the long-standing depression of prices, low starting base, existential character of needs and real economic power of users, the transition to tariffs with full coverage of waste management costs cannot be one time but it requires a transition period of gradual increases. With big waste generators, various types of the collection of charges may be applied in order to meet the demand for the provision of services and to further stimulate minimization of waste.

In determining tariffs for waste management services, one should start from a selected degree of costs coverage through collection of charges from users:

- Full coverage of costs means that tariffs generate inflows that will cover all cash outflows and the remainder of debt at the end of the project cycle, and that will provide financial assets for the replacement of facilities and equipment;
- Coverage of all cash outflows and the remainder of debt, but without providing assets for replacement investments at the end of the project cycle; this means that the replacement of capacities is financed from the capital market;
- Coverage of all cash outflows during the project period, but without providing assets for the remainder of debt and replacement investments; this means that the project is subsidised.

Such a system of service charging allows a new fiscal instrument. It is a **waste landfilling tax**. Namely, all waste that goes to a landfill should be taxable and the tax should be paid by the landfill users, as a specific tax on land where the landfill is located.

There is also a proposal to introduce **eco-tax** for specific products such as packaging materials for beverages or plastic bags.

Another instrument is **penalties for waste handling contrary to the law**. The new legal framework and the enforcement of regulations are expected to bring improvements.

The instrument of **a prolonged liability of manufacturers** for their own products is well-known in developed countries. Its substance is in the obligation of manufacturers not only to monitor a respective product during its use, while it is at the consumer’s, but also to take over the product from the consumer when the product lifetime expires, and to forward the product to recycling. In one option of this instrument, only collection of used products is performed, while in another option there is a possibility of paying certain reimbursement to the consumer. This option is often combined with a practice of giving a discount for a new product, provided that the old, used product is handed over. The new legal framework recognises this instrument. Liability has been established for manufacturers and importers of certain products that, after their use, become specific waste streams, to pay a fee to the Fund. This fee should be used for the treatment of such products when they become waste. Collection and treatment of such products will

be performed by persons permitted for waste management and who will be remunerated by the Fund for their services.

The price of real estate located in the vicinity of regional centres for waste management – regional landfills, may be lower and this fact should also be taken into account. In such cases, the owners should be reimbursed for the decrease in the real estate value.

8.4.4. Restructuring and transformation of the sector

It is very important to include competition elements and to liberalise markets of services rendered by utility companies. The change in the ownership structure of business entities cannot guarantee an increase of allocation and production efficacy. Sometimes, a too early privatization may aggravate liberalisation of sectors. It is therefore better, through contracts granting concession, to transfer rights of performing certain jobs related to waste management to private or jointly-owned companies (public-private partnership).

Introduction of competition wherever it is possible is essential for a transformation process. In order to make the sector efficient, it is important to introduce competition in the process of getting concessions and to constantly control the behaviour of concession holders. Competition in the struggle to win markets, if fair, may have positive effects on general wellbeing. Various arrangements (such as *Design Build Operate: DBO, Build Operate Own: BOO, Build Operate Dispose: BOD*, etc.) may be useful in the field of waste disposal and recycling.

On a long-term basis, a possibility is being introduced for citizens to select the most appropriate provider of waste collection and disposal services. In this manner competition would be introduced not only in the struggle to win markets, but also on the service market itself, and the prices would cease to be the subject of regulation. This would mean that the sector has definitely been liberalised, while the change of the ownership structure of business entities would take place gradually, as a consequence of the liberalisation.

8.4.5. Participation of private sector

Generally speaking, the private sector participation in the fields that traditionally were under the control of the public sector is clearly increasing. The private sector participation may satisfy many objectives: provision of investment capital, decrease of needs for subsidies, improvement of management efficacy, improvement of technical and management capacities of the local public organization, etc. There are numerous forms of the private sector participation and common classifications start from the criteria of investment, ownership and responsibility (risk).

The first group includes forms in which **the private sector participation** is the lowest: the public sector remains the owner of assets and bears the responsibility related to investments, while risks are divided in a certain proportion:

- Service provision: the private sector is engaged in performing specific activities. Contracts usually comprise shorter periods of time. The interest of the public sector is in involving the private sector expertise in the performance of certain

technical tasks or in introducing competition in the field of the performance of respective activities.
- Management: private sector takes on the responsibility for production-technological function and maintenance of municipal service companies that remain in the state ownership. An essential element of a contract is the degree of transferring the commercial risk to the private sector so that it may be sufficiently motivated to decrease costs and improve the quality of services.
- Lease: the private sector assumes the responsibility for operation and maintenance of means taken on lease and it buys the right on future money inflows of the company, thus taking the major part of commercial risk. It is often the first step towards a complete involvement of private capital, through concession.

The second group, generally called **concessions**, consists of forms of cooperation where the right of operation is transferred to the private sector on the basis of a contract, while the ownership over existing assets is retained, meaning that after expiry of a certain period, most often a long one (20-30 years), the means financed by the private sector during the contract term are taken over. A typical arrangement is BOT, usually used for new projects that include capacity building (Build), operation (Operate) during a defined period and transfer (Transfer) of ownership to the public sector after the expiry of the period. A regional waste management centre may be the subject of such an arrangement.

The third group comprises **privatisation**, full or partial. Such projects may include company management by the private sector, but they always comprise the public sector full or partial waiver of the ownership over the property. In the case of concession, the public sector has two main tasks – to ensure an adequate use of assets that it owns and, through regulation, to protect consumers of possible monopolistic pricing or low quality services. In the case of privatisation, however, the public sector has only the functions of establishing regulations.

Further development of the waste management system in the Republic of Serbia requires an increased participation of private sector. At the same time, it is significant that options are used that will motivate the private sector as much as possible to improve the quality of services and the efficiency of the system. At the appropriate option selection, it is very important that the local authority starts from its main objectives:

- Use and improvement of technical and management expertise;
- Introduction of new technologies;
- Efficiency increase;
- Building of larger capacities;
- Decrease of public subsidies costs;
- Improvement of the quality of services, etc.

8.5. Social aspects

The social aspect of the National Waste Management Strategy refers to the following:

- Manners of material usage, generation and disposal of waste and other needs and requirements related to waste management;

- Participation of users in waste management through various activities;
- Social conditions of employees engaged in waste management.

Generation of waste by the population is primarily the function of their consumption and thus their socioeconomic characteristics. At the same time, generation of waste is largely connected with people's attitudes towards waste: their manners of using materials and waste handling, their interest in decrease and minimization of waste, the degree to which they separate waste and the degree of unauthorised waste disposal. Their attitudes have influence not only on the characteristics of waste generation, but also on effective demands for waste collection services, i.e. on their interest in and willingness to pay for waste collection services. Their attitudes may be positively influenced through campaigns of public awareness raising and educational measures related to negative effects that inappropriate waste collection has on the health of population and on the environment, as well as on the value of efficient disposal. Such a campaign should also inform the population about the responsibilities they have as waste producers, as well as about their rights related to the waste management services.

The social aspect principles are as follows:

- Orientation of the waste management towards actual people's needs and demands for services;
- Encouraging of waste handling and disposal manners that contribute to the effectiveness and efficiency of utility services;
- Raising public awareness about issues and priorities related to waste management and promotion of effective economic requirements (payment) for the services of waste collection and disposal;
- Support to users' contribution to self-organisation of local waste collection and to the implementation of work within the waste management system;
- Health protection of employees engaged in waste management and improvement of their socioeconomic safety.

The implementation of the Strategy and the new legislative framework of waste management are expected to enable opening of new work places and employment of a greater number of workers, which would contribute to a decrease of poverty, development of "green economy" and inclusion of the Roma population engaged in the collection of secondary raw materials.

8.6. Staff training and public awareness raising

Development of human resources for an appropriate and sustainable waste management may be divided into three main fields:

- Professional training of staff (including a training of waste generators);
- Education;
- Public awareness raising.

The aim of staff training and public awareness raising is to make recommendations for activities that will:

- Raise the awareness of the majority of population regarding the environmental issues, especially with children and youth, creating a background for future activities and a sustainable waste management;
- Ensure adequate technical and professional competence at all the levels in institutions and organizations, as well as of all the employees in government bodies at all the levels in accordance with their competences, including private sector companies, with the responsibility of waste management and implementation of law at all the levels.

8.6.1. Staff training

A crucial improvement in waste management would be achieved by developing the skills of professionals who work in the industry and by introducing techniques and technologies in the education of future professionals who will work in the field of waste. Public awareness about waste and environment must be raised, through media, education at schools and various campaigns.

Professional training will be a primary goal in a short-term period so that waste management staff may be technically competent for their work positions. This will include requirements for training of staff in all the companies that deal with waste, as well as of staff who are responsible for waste management in ministries or local authorities. Experts in the field of waste management must provide their assistance in establishing education, as well as in the development of policy and curriculum.

Professional training is required in the following fields of waste management:

- Legal and legislative framework;
- Financial system and accountancy;
- Economic planning and budgets;
- Tender preparation;
- Licensing and monitoring;
- People's health and safety;
- Practice and procedures of waste separation;
- Practice and procedures of individual composting;
- Practice and procedures of medical waste management;
- Practice and procedures of hazardous waste management (households hazardous waste, chemicals packaging waste, etc.).

Special attention must be paid to schools. Efficient education and motivation in primary schooling will have long-term effects on behaviour of individuals. In their later ages, these individuals become participants in the realisation of various initiatives in waste management, through their daily contacts with waste.

8.6.2. Public awareness raising

The task of establishing a policy of public awareness raising in order to include issues of environment and waste is an obligation of the ministry competent for environment and of local authorities at all levels, with a support of existent professionals. Such a policy requires that all companies dealing with waste include in their contracts a campaign for raising public awareness of a quality waste management. It is essential to show to the

public the adverse effects that improper waste disposal has on the environment and eventually on people's health, and to show, on a long-term basis, municipal costs for remedy (that are remunerated from citizens' taxes and payments). The public should participate in the consideration of proposed improvements and it should be informed that these improvements in the waste management practice will return the assets from taxes through a "polluter pays" principle. Citizens must have access to the information, which has been legalized by the adoption of the Law of Acknowledging the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention).

Implementation of the legislation applicable to the public, such as prohibition of waste disposal on illegal dumps, is another mechanism for public awareness raising that must be developed. This enables a mechanism for public announcement of bad practice and the names of persons who have made greater violations.

In most cases, at the beginning of a campaign, public awareness is raised by strict enforcement of law rather than by making general information available. Here, in addition to the campaign, inspectors play a significant role with a firm message related to penalties for offenders. Persons competent for the enforcement of law and persons competent for the implementation of the campaign must work close together. On the other hand, it is important to develop trust between state authorities and citizens.

Public awareness raising campaigns encourage individual consumers to assist in achieving a sustainable waste management through decreasing waste generation, purchase of products made of recyclable materials, separation of waste for recycling and participation in local workshops on waste management. These initiatives are aimed at encouraging population to assume a more responsible attitude towards waste and to handle waste in a sustainable manner, including a waste reduction at the source, reuse of waste, recycling or reliable waste disposal if there is no other possibility.

A local campaign should:

- Use all forms of media;

- Earn the population's trust;

- Be provocative;

- Emphasise individual activities;

- Use simple targeted messages;

- Use comprehensive, but simple messages.

Special attention must be paid to raising awareness of a necessity for a sustainable management of hazardous waste and a related necessity for construction of an infrastructure including plants for storage, treatment and disposal.

9. COSTS FOR THE STRATEGY IMPLEMENTATION AND FINANCIAL PLAN

9.1. Introduction

This financial estimation includes the costs of the implementation of the Strategy objectives:

- Construction of regional centres for municipal waste management;
- Recovery and closing of the existent registered landfills and dumps;
- Recovery of hot spots;
- Construction of infrastructure for hazardous waste treatment;
- Establishing a management system for specific waste streams, etc.

Financial aspects of the waste management system pertain to planning and calculation of costs, capital investments and costs return. The financial aspects must be included in all the phases of waste management planning. In each particular waste management project a detailed financial analysis is required that will:

- Provide a reliable financial plan for coverage of expenses in the period of project implementation;
- Prove the availability of adequate financial sources for covering all further financial requirements and liabilities;
- Determine the level of tariffs required for the selected degree of refunding the financial sources through income from the project;
- Prove the financial sustainability of the project as a whole.

By an insight into the estimations of expenses for harmonisation of the national regulations of countries in transition (Central and East Europe) with the EU regulations – it has been established that capital investments for the waste sector amounted to approximately 120 EUR/inhabitant. Some countries had extremely large investments, such as Slovenia with 600 EUR/inhabitant.

This chapter shall estimate investment and operational costs of the Strategy and potential sources of financing the priority initiatives for the Action Plan 2010-2014 and long-term investments stipulated for the period 2015-2019. In addition, a possibility is under consideration to cover possible deficits of the needed investments and domestic sources of financing, and overview of economic instruments that could enable coverage for the deficit in medium-term period is also given. The chapter contains an indicative financial plan.

The estimation has been done based on the following approach:

- *waste streams and composition* have been estimated for specific *waste types* for which the Strategy stipulates a provision of *waste management system and facilities* (chapter 9.2).

- for each waste type, *total material capacities for recovery needed* to meet the objectives set in the Action Plan, as well as other necessary conditions have been defined (chapter 9.3).

- *systems, plants and equipment* needed for these capacities management have been defined (chapter 9.4).

- *capital investments and operational costs* pertaining to these systems and plants have been defined (chapters 9.5 i 9.6).

- *scope of the expected costs* with regard to the estimated GDP in the observed period has been estimated (chapter 9.7).

- national and international *financial sources* that are potentially available to finance these investments have been identified (chapters 9.8, 9.9 and 9.11).

- the issue of *coverage of* resource *deficit* that are potentially available at local level and necessary investments has been considered (chapter 9.10).

- *total investments* needed for the Action Plan and strategic measures implementation by 2019 have been determined, as well as *responsibilities to finance* measures in private and public sector (chapter 9.12).

- *indicative financial plan* has been prepared using general assumptions about possible funding inflows from different national and international sources (chapter 9.12).

- *economic instruments that could mitigate unbalance* between the investment costs and estimated financial sources have been identified (chapter 9.13).

- necessary institutional resources for priority measures referred to in the Action Plan have been estimated (chapter 9.14).

The analysis has been implemented at incremental basis, identifying systems, plants and equipment that will be needed in future in addition to already existing waste management systems. It is assumed that necessary renewal of the investment fund will occur after the expiry of the considered period (2010-2019). The costs were estimated in EUROs, in permanent prices from 2009.

9.2. Waste streams

Using the data on waste composition from chapter 4.2, estimates of waste streams from Appendix 4 are broken down into specific waste streams management of which has been stipulated in the Strategy and Action Plan. Table 9.1 shows summary estimates for waste streams for the observed period. Diagram in Figure 9.1 illustrates these streams for 2014 and quantifies waste streams and mass material balance for the same year.

Table 9.1. Estimated waste quantities expressed in thousands of tonnes at annual level

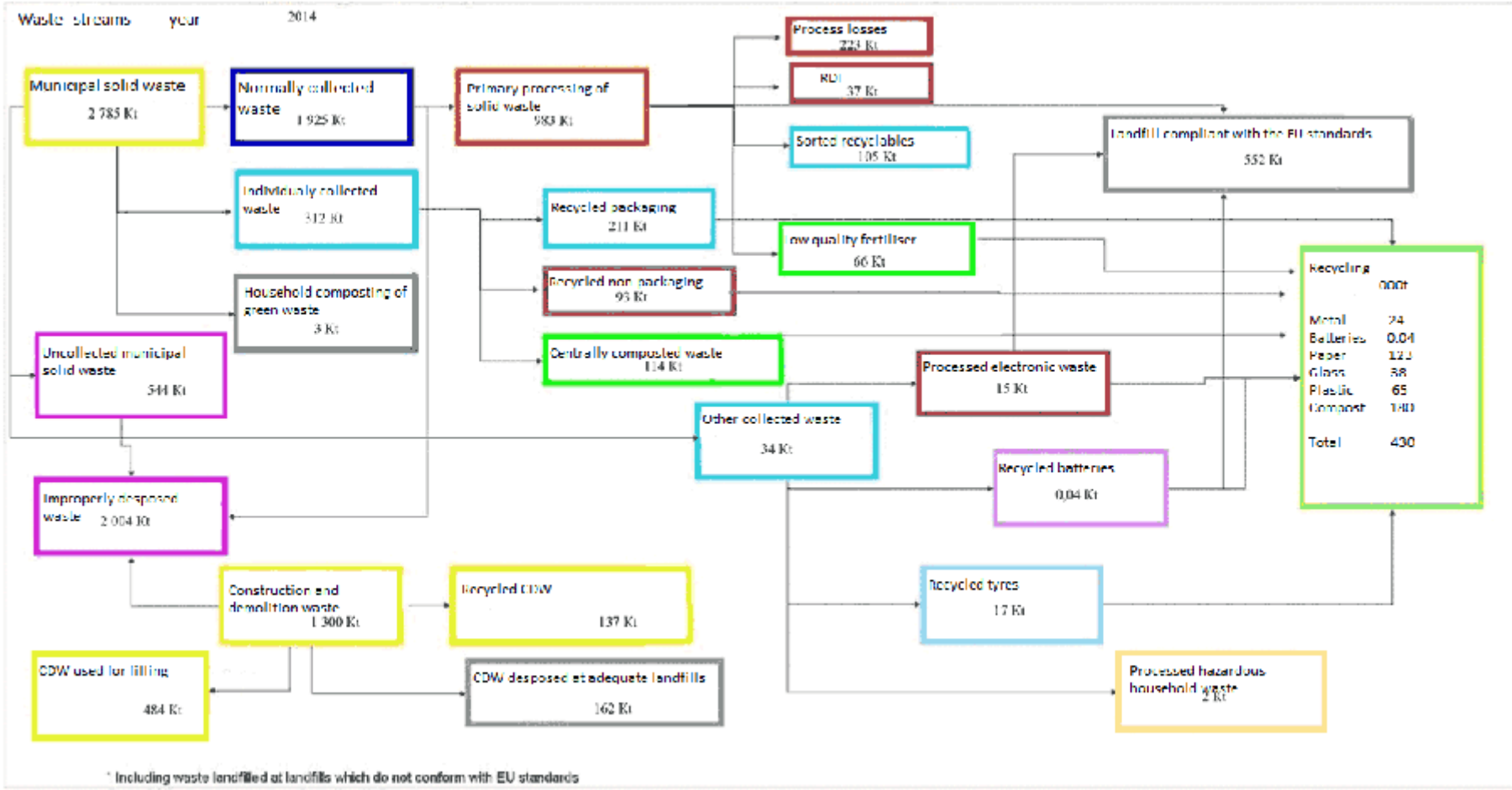
Year	**2010**	**2014**	**2019**

Municipal waste	2451	2785	3268
Household waste	*2084*	*2367*	*2778*
Commercial waste and waste generated in institutions	*367*	*418*	*490*
Packaging	607	693	817
Biodegradable municipal waste	1538	1747	2049
Hazardous municipal waste	25	28	33
Construction and demolition waste	1000	1300	1700
Hazardous industrial waste	100	150	200
Waste oil	50	54	59
Waste tyres	26	30	34
Batteries and accumulators	27	29	32
Waste electric and electronic equipment	30	35	40
End-of-life vehicles	93	106	124
Medical waste	49	52	56
Sludge from municipal WWTPs	30	160	350
Animal waste	277	296	321

9.3. Waste management capacities needed in the future

Taking into account data about waste streams and infrastructural development measures in the priority Action Plan for the period 2010-2014 and medium-term period 2015-2019, *additional* needed capacities for waste management have been defined, since they are needed for implementation of each individual measure in each year of the observed period. The estimate shows that most necessary additional capacities are those for municipal waste management, including packaging waste, construction and demolition waste and sludge from municipal WWTPs.

Figure 9.1: Estimated waste streams, 2014.


Waste streams year 2014
Municipal solid waste
2 785 Kt
Normally collected waste
1 925 Kt
Individually collected waste
312 Kt
Household composting of green waste
3 Kt
Uncollected municipal solid waste
544 Kt
Improperly disposed waste 2 004 Kt
Primary processing of solid waste
983 Kt
Process losses
223 Kt
RDF
37 Kt
Sorted recyclables
105 Kt
Recycled packaging
211 Kt
Recycled non packaging
95 Kt
Centrally composted waste
114 Kt
Other collected waste
34 Kt
Low quality fertiliser
66 Kt
Landfill compliant with the EU standards
552 Kt
Processed electronic waste
15 Kt
Recycled batteries
0,04 Kt
Recycled tyres
17 Kt
Processed hazardous household waste
2 Kt
Recycling
000t
Metal 24
Batteries 0,04
Paper 122
Glass 58
Plastic 65
Compost 180
Total 430
Construction and demolition waste
1 300 Kt
Recycled CDW
137 Kt
CDW used for filling
484 Kt
CDW disposed at adequate landfills
162 Kt
* Including waste landfilled at landfills which do not conform with EU standards

9.4. Systems and facilities for waste management

For each priority measure, type, number and costs of waste management systems and facilities have been estimated, that will be necessary to meet future needs. Twelve regional centres for municipal waste management are of particular importance, and they should be constructed in the period defined in priority Action Plan 2010-2014, assuming that additional 12 will be constructed in the period 2015-2019. Number, scope, extent and costs for the centres will depend on discrepancies between urban and rural areas, thus differentiating three categories: urban, mixed and rural area.

9.5. Capital investments costs

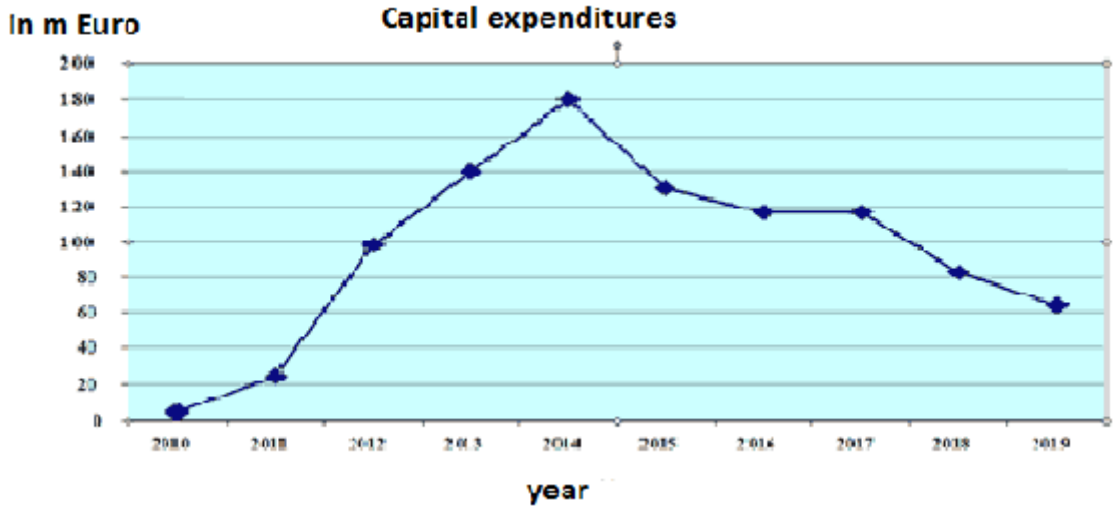
Estimates made for the investments into additional capacities for waste management are shown in Table 9.2.

Table 9.2: Summary overview of total investment costs for the period 2010-2019, expressed in million EURO

	Year 2010-2014	**2015-2019**	**2010-2019**
Municipal waste – total investment costs, including:	380	426	806
Extension of collection coverage	43	53	96
Directive on landfills	273	223	496
Directive on packaging	57	142	199
Directive on batteries	-	-	-
Directive on WEEE	8	8	15
Construction and demolition waste	28	32	59
Hazardous industrial waste	14	24	38
Medical waste	2	1	3
Directive on waste oil disposal	4	-	4
Directive on end-of-life vehicles	11	20	30
Waste tyres	5	-	5
Sludge from municipal WWTPs	-	-	-
Animal waste	4	8	13
Total for investment costs	447	511	958

Total estimated investments necessary for the application of measures stipulated in the Action Plan for the period 2010-2014 amount to €447 million and €958 million cumulatively by 2019. As expected, the major part of total investment costs pertains to municipal waste management systems and plants. For that purpose, €380 million are necessary by 2014 (85% of total amount) and €806 million by 2019 (84% of total amount). The investment programme has been shown in Figure 9.2. Annual investments reach their maximum in 2014, when they amount to 180 million EURO, gradually and evenly decreasing by 2019.

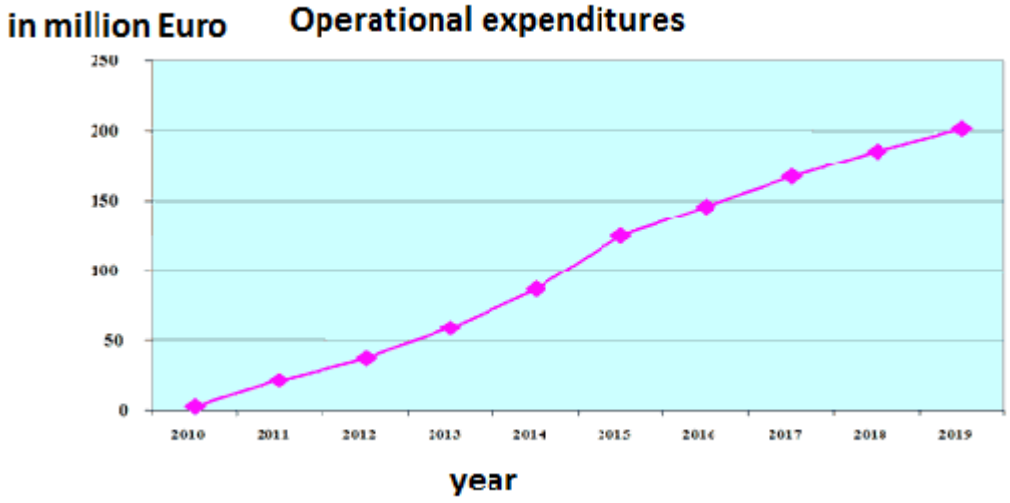
Figure 9.2: Total annual investment costs in the planned period



9.6. Operational costs

Figure 9.3 provides for summary overview of overall annual operational costs in incremental systems and waste management facilities, excluding depreciation costs. Operational costs grow evenly in accordance with the investment accumulation and they amount to 201 million EURO p.a. in 2019.

Figure 9.3: Total annual operational costs



9.7. Costs expressed at annual level

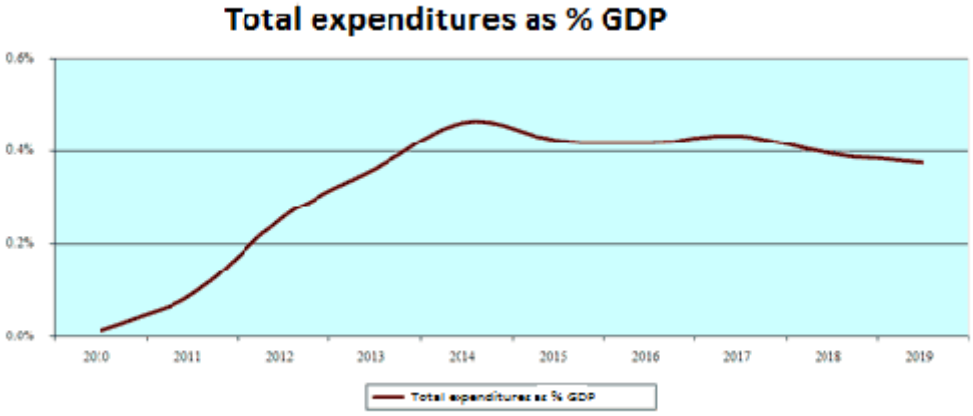
Implementation costs for the Action Plan and subsequent measures for the society may be placed in the context by making comparison with the estimated GDP over the implementation period. There are two approaches for illustration:

- Comparison between the sum of overall annual capital investments and operational costs with the estimated GDP, and
- Conversion of cumulative capital expenditures into capital costs at annual basis and comparison between total annual costs (operational costs plus capital costs at annual basis) with GDP.

Total expenditures compared to the estimated GDP

Figure 9.4 shows total investment and operational costs as a percentage of the estimated annual GDP.

Figure 9.4: Total expenditures shown as % of the estimated GDP



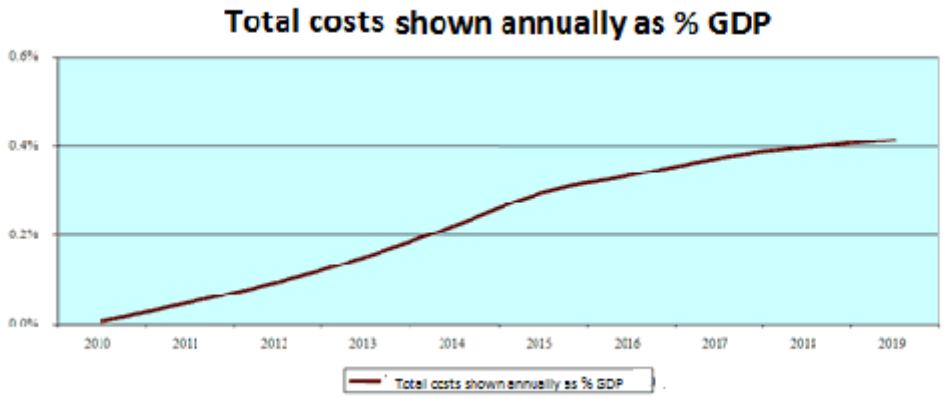
It is obvious that total expenditures as % of GDP grow to almost 0.49% in 2014, falling to almost 0.39% in 2019. It should be taken into account that relative fall in capital expenditures after 2014 (Figure 9.2) is compensated through even growth of operational costs (Figure 9.3), so total share in GDP mainly remains constant. This can be compared to a total of 0.35% of GDP, the amount that was allocated for environmental protection from the Republic budget in 2008.

Total costs at annual level compared with the estimated GDP

Costs calculated at annual base are composed of annual operational costs plus estimates of costs for utilisation of assets to be used throughout the year. This is the indicator of costs for utilisation of national resources throughout the year, and it can be calculated as a percentage of the estimated GDP. It provides for costs estimates for resources that pertain to waste management programme, costs for economy that are

expected to continue in the future. Figure 9.5 shows growth in total costs at annual level in 2019 to 0.43% of GDP.

Figure 9.5: Costs showed at annual level as % of the estimated GDP



9.8. Financing of the investment programme

Estimates about financing options for different investments during the implementation period include considerations of three key questions:

- Who will be responsible for creation of these investments (investors)?

- Who will provide for capital for those investments (sources of financing)?

- How will the investment and operational costs return be ensured (costs return)?

The Republic, provincial and local authorities have the prevailing responsibility for provision of services in the area of municipal waste management, management of sludge from municipal WWTPs and medical waste management, and they will invest significantly into new systems and infrastructure for these waste streams management. It is expected that private sector gets an important role in the investments and provision of these services through private-public partnership arrangements, to which they can provide funds and operational knowledge and experience.

It is expected that private sector will significantly participate in provision of capital and/or long-term commercial loans for waste streams which are primary responsibility of private sector. These streams include hazardous industrial waste, construction and demolition waste and waste streams related to certain products, including packaging and spent batteries. Among private investors, there will probably be providers of waste management services and major industrial waste generators, as well as companies or organisations that were established in compliance with legal requirements or were established to meet obligations prescribed by law.

It should be remembered that not only is it necessary to finance municipal regional structures and private sector functioning, but also technical assistance needed to provide support to organisational and financial structures that are key to long-term sustainability of service provision. Technical assistance will be necessary to provide support to preparation of approximate strategies and implementation plans of certain Directives. Preparation of documentation for applying for project financing is a long-term process which would benefit from well-targeted technical assistance.

9.9. Available financial resources in the Republic of Serbia

Potential domestic sources of financing are the following:

- Grants provided by the Fund;
- The Fund's loans;
- Budget funds from local self-government and PUCs (own funds);
- Loans from local commercial banks;
- Investments from private capital into local PPP models.

The Fund's grants

The expectation is that the Fund's grants become the main source of available state financing for municipal waste management public projects, and that those grants will be provided primarily for the investments into regional systems for municipal waste management. The grants that are potentially available in this source are limited at €1 million per region, at a total amount of €12 million for 12 regions proposed for priority investment period 2010-2014. Similar funds are stipulated for medium-term period 2015-2019, as well. These amounts are negligible compared to the necessary investments. Usual contribution of state to the regional waste management systems in the countries that have acceded to the European Union range between 20 and 25% of the initial project investments.

The Fund's loans

The Fund administrates loans to companies for environmental projects financed by the Development Fund of the Republic of Serbia. Maximal amount of these loans is very low, and is not a significant source for the Strategy financing.

Budget funds of local self-governments and public utility companies (own funds)

Local self-governmental capacities to finance infrastructural projects are low, and improvement is not expected in this term in short period of time. Belgrade municipalities are exemption, since they are characterised by strong economic activities and stable revenue flows collected from construction fees and other sources that smaller and poorer municipalities do not have. Municipal bonds have been introduced recently as one of the options for municipality financing; however, they are only expected to achieve better position in financing. General financial state suggests that it is not probable that this will be a sustainable source of financing, except for in the case of bigger municipalities with stronger financial capacities.

Loans from domestic commercial banks

Commercial loans are potential source of financing for municipal infrastructural projects, but restrictive conditions indicate that this is not a realistic source of financing for an investment programme.

Investment of capital into local PPP models

Investment of private capital is limited in Serbia, although PPP starts to appear as a solution for provision of municipal infrastructure, including waste management projects. Yet, it is probable that international waste management companies become the main investors in this area.

9.10. Estimated financial deficit

It is evident that domestic capital for financing of public of private sector in the area of waste management systems and facilities in Serbia is insufficient, and that deficit between the necessary investments and domestic financial sources is quite high. It would be unrealistic to expect that such deficit will be covered to great extent in the period up to 2014 and later on.

Chapter 9.13. explores the possibilities of economic instruments to cover the deficit. The capacity to generate reliable and foreseeable inflows is the key factor for financial sustainability of municipal services that pertain to waste and ability to mobilise external sources of financing. A clear and unambiguous national policy for costs coverage and tariffs that pertain to waste is needed. Introduction of waste disposal fee, as well as additional charges, is a mechanism aimed at the development of ecologically stable systems for waste management on one, and generation of additional revenues to finance these development activities on the other hand. Measures like these are expected to reduce deficit in medium-term run.

Still, in short-term run, it will be necessary to take into account the international sources of financing as the main tool to cover municipal funding deficit. If financial deficit also exists in the domestic offer of funds for private sector investments, then there is a possibility to use foreign private sources. The possibility to approach those funds will depend on credibility, including reliability of inflows that are the basis for project sustainability.

9.11. Potential international sources of financing to cover the deficit

Size of the expected deficit indicates expectation that foreign financial sources play an important role in provision of capital to co-finance waste management infrastructural programmes. Potential international sources of financing are the following:

- grants provided for through the European Union Instrument for Pre-Accession Assistance (IPA);
- bilateral grants and long-term loans;
- long-term loans from international financial institutions (IFI);
- public-private partnership arrangements (PPP);

- private investors' capital;
- long-term loan capital from commercial financial institutions.

Financial aid from foreign sources is also available for project preparation purposes, such as technical assistance for feasibility studies, cost-benefit analysis and project application-related matters. These potential sources will be analysed in details during the Strategy implementation period.

The European Union Instrument for Pre-Accession Assistance (IPA)

It is expected that grants obtained through the European Union Instrument for Pre-Accession Assistance (IPA) be the main source of financing for the proposed municipal waste management systems and facilities harmonised with the EC. It is necessary to define details that will define when IPA funds will be available, and what amount is intended for waste sector. The EU grants are the main financing source of projects in the area of municipal waste in many countries that have recently become the EU member states. Use of funds is generally justified with the fact that harmonisation with the EU legislation in the area of waste management imposes costs that not all the members of the society can bear at this moment, but it is expected that over the time, they will become affordable as household income increases. Grants enable that fees paid by users stay below the level that would be needed if full costs for these services are applied, including the capital price that should be covered from the tariffs.

It is deemed that it is of key importance for future sustainability of waste management services is to define the national cost recovery policy, as well as tariff and affordability policies, regardless whether the assistance comes from the EU grants or from PPP model. Additional considerations are provided in chapter 9.13.

Bilateral grants and credit capital

Bilateral assistance in the form of grants for technical assistance and investment financing is obtained through programmes established by the national agencies in many European countries. Donors usually ask for a kind of financial obligation from the project initiator, usually in the form of application for co-financing from the own funds. Provision of financial assistance to big infrastructural investments, bilateral grants may play an important role in mobilising other source of financing, including long-term loans from international institutions. In addition, financing from grants may reduce pressure of fee increase, when using credit financing. It is necessary to closely explore possibilities for obtainment of technical and investment assistance from bilateral agencies. The Government should explore that in short time period.

Loans from international financial institutions (IFI)

Loans from international financial institutions are an important potential source of co-financing of municipal and commercial waste management facility. International financial institutions provide for technical assistance for project preparation. Financial assistance is usually provided in a form of soft loans, which means that conditions for loan return are more favourable than the conditions in case of commercial loans. Project developers face strict requirements for loan granting, including technical, economic, social and ecological criteria that project has to fulfil. Financial status, capacities and crediting

capacities of user's organisation is closely examined. The examples are European Investment Bank (EIB), European Bank for Reconstruction and Development (EBRD) and the World Bank (WB).

Public – Private Partnership

It is necessary to encourage greater participation of private sector in waste management system in the Republic of Serbia. It is expected that industrial and commercial waste management systems and facilities, as well as those for specific waste streams, are financed primarily from private sector funds. PPP arrangements are emerging in the Republic of Serbia as a sustainable tool for financing and operation of municipal waste management infrastructure.

PPP plays an important role in provision of municipal waste management facility in the Republic of Serbia. The range will, however, greatly depend on the policy within which PPP model is prepared. Legal, regulatory and institutional structure within which PPP arrangements are prepared and implemented should be urgently revised.

International capital (private investments)

Private sector investors (e.g. operators in the area of waste management, bigger industrial waste generators and companies/organisations that were established to fulfil legal obligations in terms of specific waste streams related to specific product) usually finance investments through combination of own capital and loans. Long-term loans from commercial financial institutions are a potential source for financing optimisation for private investments in waste management facilities.

9.12. Indicative financing plan

It has been estimated that investment needs amount to 447 million Euro for the period 2010-2014 and 511 million Euro for the period 2015-2019 (a total of 958 million Euro).

Public sector will be responsible for 71% (317 million Euro) of the investment programme for the period 2010-2014 and 54% (277 million Euro) in the period 2015-2019. This makes 62% (595 million Euro) of total estimated investments in ten-year period. As already stated, a part of investment needs may be financed from private sector through PPP arrangements.

As for municipal waste, sludge from municipal WWTPs and medical waste, the investments into systems and facilities will most probably be financed through the following combination:

- capital grants from the Fund;
- funds for the project provided by private sector within the PPP model;
- capital grants through EU IPA;
- funds from local self-governments and PUCs (own funds);
- long-term loans from international financial institutions;
- capital grants from bilateral donors.

At this moment it is not possible to be certain about the amount of funds that will be available from the mentioned sources.

It is expected that waste management systems and facilities, under the responsibility of private sector (including industrial and commercial waste, packaging waste, end-of-life vehicles, waste oils, etc.), will almost completely be funded by private sector from its own capital and/or long-term commercial loans.

9.13. Instruments to cover financial deficit

Economic instruments may contribute to decrease of financial deficit through expansion and mobilisation of sources and amounts available for investments into public waste management systems and facilities. These instruments include cost recovery policy and landfilling fees. Capacity building in the national agencies for identification, exploration and monitoring of potential financing sources also has the capacity to decrease financial deficit.

Cost recovery and tariff policy

The ability to finance investments into waste management systems will depend on creation of reliable and foreseeable cash flows that are sufficient for:

- loan servicing and repay;
- coverage of regular expenses in the course of operation, including replacement of assets;
- coverage of costs that pertain to the plant shutting down, recovery and investment maintenance, and
- in the case of private investors, generation of profit from the capita that is measurable with opportunity costs of the investor and business risks.

Investments into waste management defined in the Action Plan are more expensive in terms of their development and functioning with regard to the existent systems and they have to be financed and paid for. European policy and legislation are clear in this respect – waste generators shall pay (through user charges) for the whole amount of services and plants that are needed for management of their waste in environmentally adequate manner. This depends on the efficient cost recovery and collection system, which is based on the polluter pays principle to greatest possible extent. The functioning of an effective and efficient collection system is of key importance in order to avoid severe budget deficit and overdependence on public budgets for provision of these services.

Defining the prices for use of waste management plants and services at the levels that reflect their full long-term costs is a prerequisite for financing and existence of necessary plants and infrastructure. Still, it has to be recognised that such policy must be introduced gradually, enabling the users to take into account and to adapt to higher prices for use of public facilities and services. Grants may help to abate transition to full cost recovery prices for the provided services.

All countries that recently became the EU member states were concerned for the degree of affordability of prices for waste management services for users, and many adopted

specific procedures in that respect. Almost everywhere, an upper limit was defined for the share in a household income to be allocated for waste management services. The definition of this “affordability limit” varies from country to country.

For example, waste tariffs in Czech Republic are at the level of 0.7% of average household income. In Romania, tariffs for waste do not exceed 1.5% of poorest household income, but they allow for possibility to introduce more complex tariff structures based on affordability. Comments related to affordability limit are given in the text below:

- Introduction of affordability limit for waste management tariffs recognises that full price for improved services is not affordable for all users. This, in fact, is the justification for use of the EU grants.
- Except for in cases of introduction of different tariffs according to affordability level, the affordability limit has a subsidising effect to those who can pay higher fees. This results in relatively low inflow, which on the other hand can result in relatively high level of the EU grants for regional waste management projects. Taking into account competition when applying for limited financial funds, it is necessary to consider carefully whether this is the wanted outcome.
- Use of the EU grants and maintenance of tariffs at lower level than full cost recovery level is not in compliance with the requirements for full cost recovery that are usually related to PPP models.
- It would be ideal that users pay different tariffs up to the full cost recovery level in accordance with their affordability level. Still, this is very difficult to apply in practice, since such system would imply knowledge about the income level of individual households.
- The alternative approach is seen in recognition of specific vulnerable groups with low income, who apply for subsidised services, while the remaining population would pay full amounts which reflect full cost recovery to great extent.
- Significant discrepancies are seen in average income between different regions, but also within a region. Understanding of social-economic conditions in the region and municipalities that make that region, is a key element for preparation of a sustainable project, structure and level of fees.

Yet, as for PPP arrangements, private investors will want to have full operational cost recovery (including depreciation), and that return to the invested capital be proportional to business risk. Private investors expect certain level of reliability of cash flow estimations. In addition, except for when PPP arrangements are also supported by grants (which is not so common), long-term sustainability of business will require that tariffs are defined in such manner that they ensure all costs recovery.

It has to be admitted that, while sustainability of private sector investments depends on the introduction of tariff structures based on full cost recovery principle, tendency to use the EU (and other) grants is actually the recognition that tariffs that stipulate full costs recovery are not affordable (at this moment) for the majority of population, and that sustainability of these services depends on subsidy approach to cover part of those costs. Taking into account that it is difficult to combine the EU grants with PPP, the most efficient approach would be to finance some projects from the EU funds, while the others would be financed from private sector funds.

Creation of a detailed overview of costs and tariff policies in municipal waste management sector is recommended, recognising the limitations that pertain to affordability of a household to bear costs, invoicing options and implications of private sector participation. The aim is to propose systems for introduction and collection of fees for waste management services tariffs of which will be progressively increased until they reach a level that reflects total costs of functioning. This may involve different methods for collection of fees from households and commercial waste generators. Different needs for projects financed from the EU grants and PPP arrangements should also be taken into account.

Bearing in mind that selection of cost recovery method for municipal waste management services is a complex issue, it is necessary to explore and implement pilot test with the parties concerned before making a final decision.

Landfilling and other fees

Possibilities to develop and implement a fee system for landfilling and/or additional fees for waste management was elaborated in section 8.4.3. The idea that stands in the system of differentiated, growing fees was developed in Czech and Slovakia in the nineties. Certain specificities of such a system may vary, but they are basically composed of two parts:

- Basic tariff per tonne of waste landfilled in licenced landfills (A-tariff), and
- Additional fee based on fee per tonne landfilled in licenced landfills that are not harmonised with technical requirements that are applied to new landfills (B-tariff).

End user of basic A tariff is local self-government where subject landfill is located. The main goal is to increase readiness of municipalities to agree that landfill is constructed at their territory and to guarantee minimal level of revenues into the municipal budget from waste disposal. Usually, only those local self-governments where landfills are not located do pay a basic tariff, thus contributing to provide the municipality where landfill is located with compensation for social and ecological consequences of landfill locating.

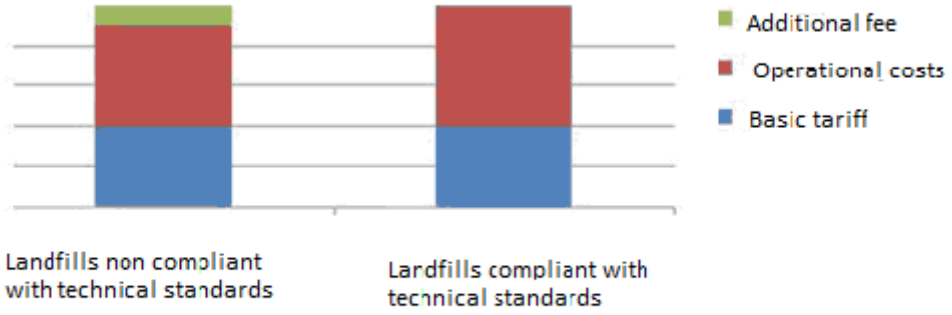
B tariff is a tool to cover external costs imposed to the society by the facilities that are not compliant. In such way, a discrepancy between higher costs of compliant facilities and higher social (ecological) costs for non-compliant ones would be settled. Making the disposal expensive in this way, fees have the role to stimulate waste generators to avoid use of such facilities. The end user can be the Fund, collecting the fees and depositing them at the account which provides for grants for suitable public waste management projects.

This basic structure may contain variations, but the fee will most commonly be:

- Tax for landfilling of all types of waste and disposal at other locations that are not compliant with the requirements and technical regulations of the European Union and the country itself.
- Differentiation according to whether waste is inert, biologically active of hazardous one.
- Annual increase in accordance with legally binding and adequately published plan, until pre-defined level is reached.

- Collection by those who own/manage landfills or other facilities and periodical transfer of revenues to the earmarked account of the Fund.
- The resulting revenue deposited ay the Fund's account in previously determined period of time, shall be solely used for (i) compensation for local self-governments where new facilities are located, harmonised with the EU; and (ii) co-financing of investments into new landfills and other facilities for waste management that are harmonised with the EU requirements.

The structure of the economic instrument is shown in the following diagram, showing the proportion between the economic instrument and waste disposal price, part of which are tariffs A and B.



Introduction of such a system has proved to be very efficient in other countries, both in terms of revenues generation, and in introduction of substantial changes into waste disposal practice. For example, introduction of landfill fees in Czech Republic and Slovakia in 1992 helped in enabling the closure and recovery of numerous uncontrolled dumpsites which were improperly managed, and to develop the national network of well-conceptualised sanitary landfills, adequately managed. It should be stressed that municipal waste management services are primarily provided through private sector arrangements in these countries.

Feasibility of introduction of this type of policy basically depends on detailed assessment and decision on cost recovery, affordability and tariff structure in municipal waste management system. The intention is to closely explore the possibility to introduce such a charging system within this comprehensive review, which would include different potential implications of such a system to projects financed from the EU grants and PPP arrangements..

Overview of roles and resources in the Ministry of Environment and Spatial Planning and the Fund

It is necessary to review and expand, if necessary, the role and resources of the Ministry and the Fund, dedicated to financing the waste management system and facilities in compliance with the Strategy objectives and future requirements of the EU. This

particularly pertains to the fact that significant role is stipulated in the development of economic instruments mentioned in this chapter, especially in order to identify and mobilise external grants from bilateral donors so as develop cost recovery policy, tariffs for waste management and landfill tax, and in order to provide advice related to stimulation mechanisms for higher participation of private sector in provision of infrastructure for municipal waste management.

Overview of rules that enable local self-governments to collect funds

In accordance with clear rules and guidelines, it is necessary to revise the rules that enable local self-governments to have more freedom and flexibility in terms of crediting, obtainment of capital assets from other sources and establishment of PPP with service providers in this sector and financial institutions.

9.14. Administrative resources

Administrative resources will be needed for the Strategy implementation at the national, provincial and local levels, and they will fluctuate significantly. On one hand, this primarily pertains to the implementation of necessary legislative, institutional and organisational measures, and to the development and supervision over the waste management system and infrastructure on the other. It will be necessary to re-group adequate administrative resources needed for the Strategy implementation in accordance with the National Plan for Integration of Serbia into the EU, distinguishing different resources needed for the following:

- Implementation of time limited tasks, such as preparation of implementation plans or planning;
- Implementation of permanent functions, such as monitoring and application of rules in “still status” circumstances;
- Analysis of policies, such as the establishment of the national cost recovery and tariff policy;
- Functioning at maximal level of work load.

It is expected that many of the resources needed for the implementation of time limited tasks can be financed by the EU or from bilateral technical assistance programmes. Accomplishment of tasks that pertain to permanent functions will require appropriate resources that must be re-grouped. Achievement of maximal operational level, especially in the course of first several years of the Strategy implementation, will be most difficult in terms of planning and provision of resources. This is of key importance if efficient project preparation, financing, implementation and management is wanted.

10. MONITORING OF THE WASTE MANAGEMENT STRATEGY IMPLEMENTATION

10.1. Indicators for the Strategy implementation

Indicators are very important for a successful assessment of taken measures and activities. The selection of indicators reflects a relation with crucial proposed instruments.

Indicators related to waste issues are of an environmental pressure type. The mere existence of waste, once generated, requires that the waste should be disposed somehow, i.e. collected, transported, landfilled, treated etc. In addition to passing regulations, responses of the society to such pressures include economic instruments, as well as waste management strategies and plans, which are expected to influence the decrease in waste generation and the provision of acceptable measures for waste handling.

The Agency is an institution competent for monitoring the indicators. The selected indicators have been prepared on the basis of necessities for information at the national level, as well as of liabilities that arise within the international exchange of information, and they are internationally comparable and harmonized.

Table 10.1 Indicators used to monitor the strategy implementation

A	**WASTE GENERATION**	
1	Total quantity of generated waste	Total quantity of generated waste per year (t/year)
		Total quantity of generated waste per person and per year (kg/person/year)
		Total waste generation in groups according the Waste Catalogue per year (t/group/year)
2	Waste generation intensity	Quantity of waste per person (kg/person) according to GDP per capita (EUR/person)
3	Quantity of generated municipal waste	Quantity of generated municipal waste per year (t/year)
		Quantity of collected municipal waste per year (t/year)
		Municipal waste generation per person (kg/person/year)
		Number of persons that benefit from the public waste collecting services (% of the total number of inhabitants)
		Total waste generation of households (t/year)
		Total quantity different sorts of waste collected separately – paper, glass, metal, plastic, organic waste, biological waste etc. (t/class/year).
4	Quantity of generated hazardous waste	Quantity of generated hazardous waste per year (t/year)
		Quantity of generated hazardous waste per person and per year (kg/person/year)
		Quantity of generated hazardous waste from households (t/year)
		Quantity of generated hazardous waste in groups according to the Waste Catalogue (t/year)
5	Quantity of generated industrial waste	Total quantity of generated industrial waste per year (t/year)
		Waste generation in groups according to the Waste Catalogue per year (t/group/year)
6	Quantity of generated packaging waste	Quantity of generated packaging waste per year (t/year)
		Quantity of generated packaging waste per person (t/person/year)

		Recycling percentage of the different kinds of packaging material the total quantity of material being generated (% of the total quantity)
7	Quantity of generated biodegradable waste	Total quantity of generated biodegradable waste per year (t/year)
		Generation of biodegradable waste per person (kg/person/year)
		Quantity of biodegradable waste used as compost (t/year)
8	Quantity of generated waste from construction and demolition	Total quantity of waste generated from construction and demolition activities (t/year)
		Quantity of waste from construction and demolition activities per person (t/person/year)
9	Quantity of generated electronic waste	Total quantity of generated electronic waste per year (t/year)
		Total quantity of generated electronic waste per person and per year (t/person/year)
10	Quantity of end-of-life vehicles	Quantity of end-of-life vehicles per year (number/year)
		Quantity of end-of-life vehicles per person and per year (number/person/year)
11	Quantity of waste tyres	Quantity of waste derived from waste tyres (t/year)
		Generation of waste derived from waste tyres per person and per year (t/person/year)
12	Quantity of generated waste oils	Total quantity of oil delivered to the market (t/year)
		Quantity of collected waste oils per year (t/year)
13	Quantity of waste sludge generated by the WWTP	Quantity of waste sludge generated by the WWTP per year (t/dry matter/year)
		Quantity of waste sludge generated by the WWTP per person and per year (t/person/year)
14	Quantity of medical and similar waste	Total quantity of medical and similar waste (t/year)
B	**INFRASTRUCTURE (FACILITIES, COMMERCIAL ENTITIES)**	
15	Sanitary landfills	Number of sanitary landfills (number)
		Total capacity of the sanitary landfills (t)
		Remaining capacity of the sanitary landfills (t)
16	Commercial entities authorized for waste management	Total number of commercial facilities (number)
		Number of commercial facilities as per class of waste (number)
C	**WASTE MANAGEMENT**	
17	Quantity of recycled waste	Total quantity of recycled waste (t/year)
		Total quantity of recycled packaging waste (t/year)
		Total quantity of recycled packaging waste as per class of waste (t/year)
18	Quantity of biodegradable waste	Total quantity of biodegradable waste (t/year)
19	Quantity of separately	Total quantity of separately collected waste (t/year)

	collected waste	Total quantity of separately collected waste as per class of waste (t/year)
		Total quantity of separately collected waste derived from packaging material(t/year)
		Total quantity of packaging waste collected separately as per class of waste (t/year)
D	**TRANSBOUNDARY MOVEMENT OF WASTE**	
20	Transboundary movement of waste	Transboundary movement of waste per year (import/export/transit) (t/ year)
		Transboundary movement of hazardous waste per year (import/export/transit) (t/ year)
		Transboundary movement of hazardous waste (import/export/transit) as per classes defined in the Waste Catalogue (t/ year)

11. ACTION PLAN

The Action Plan shall include specific measures to be undertaken in order to provide for conditions for the implementation of the Strategy objectives, entities to implement those measures are also identified, as well as deadlines for the implementation.

11. ACTION PLAN 2010-2014

Objectives	**Activities & measures**	**Competent institution and partners**	**Implementation deadline**
1. To harmonise national regulations in the field of waste management with the EU legislation	1. To adopt all bylaws on the basis of the Waste Management Law and the Law on Packaging Material and Waste	MESP	2010
	2. To strengthen administrative capacities, especially the institutions and organisations in charge of planning,	MESP, AP, LSG, SEPA, SCC	2010

	permitting, controlling and monitoring		
2. To adopt national plans for individual waste streams	1. To draft a national plan for the reduction of packaging waste	MESP, AP	2010
	2. To adopt a national plan regarding biodegradable waste management (implementation of 99/31/EC Directive)	MESP, AP	2011
3. To develop regional and local waste management plans for all regions to 2013	1. To create inter-municipal agreements on joint waste management	LSG	2010
	2. To establish local and regional institutions in charge of waste management and capacity building	LSG, MESP, AP	2010
	3. To collect data on the quantity, composition and morphology of municipal waste	LSG	2010-2011
	4. To adopt regional waste management plans	MESP, AP, LSG	2011-2013
	5. To adopt local waste management plans	LSG	2010-2012

	6. Feasibility studies for the construction of waste management plants	MESP, LSG, PUC	2011-2013
	7. To raise public awareness about the necessity and conditions to build regional waste management plants	LSG, MESP, AP, SCC	2010-2013
4. To increase the number of persons covered by waste collecting system to 75% until 2013	1. To create guidelines in order to expand municipal waste collection in rural areas	LSG, MESP	2010
	2. To raise public awareness in rural areas where waste collection will be performed	LSG, MESP, AP, SCC	2010
	3. To build facilities in order to expand the volume of services (through PUC and PPP)	LSG, PUC	2011
	4. To procure necessary vehicles and containers and to build collecting stations	LSG, PUC	2011
	5. To monitor results of the newly	LSG, PUC	2011

	expanded services in conformity with regional waste management plans		
5. To develop a primary selection system of waste materials at the level of local administrations	1. To draft a Programme regarding the organisation, selection and collection of waste that will be recycled	MESP, AP, LSG	2010
	2. To raise public awareness about the necessity of collecting waste separately at source	LSG, MESP, SCC	2010-2013
	3. To put colour containers for separate collection of recyclable waste in LSG	LSG, Commercial entities	2010-2013
	4. To build centres for the separate collection of waste in urban areas	LSG, Commercial entities	2010-2013
	5. To research and develop the market of recyclable waste materials	Commercial entities	2010-2013
6. To build 12 regional waste management centres until 2013	1. To adopt regulations regarding the location choice and the technical and	MESP	2010

(regional landfills, recyclable waste selection plants, recyclable waste separation plants, plants for the biological treatment of waste and transfer stations in each region)	technological conditions for the construction of waste management plants in compliance with the Law on Waste Management		
	2. To enter into inter-municipal agreements about joint management of waste in waste management regions	LSG	2010
	3. To establish institutional organisation for the regional waste management	LSG, MESP, AP	2010
	4. To prepare technical documentation and studies that will assess environmental impact of 12 regional waste management centres	LSG	2010
	5. To build 12 regional waste management centres (regional landfills, plants for the separation of recyclable waste, biological	MESP, AP, LSG, Fund	2010-2013

	treatment plants) in conformity with the National Waste Management Strategy		
	6. Economic instruments: to introduce full recovery of expenses of waste collection and disposal services	LSG	2011
	7. To build transfer stations for reloading municipal waste for transportation	LSG	2010-2013
	8. To establish a system and build centres for separate collection of recyclable waste in urban areas that belong to subject regional waste management centres	LSG, Commercial entities	2010-2013
	9. To draft feasibility studies for anaerobic digestion plants	MESP, LSG, Commercial entities	2012
7. To establish a management system for hazardous waste in	1. To create an operative program for hazardous waste management	MESP, AP	2010

Serbia (to build central regional storages for hazardous waste and to begin construction of a plant for the physical-chemical treatment of hazardous waste until 2013)	2. To establish an operative company (public enterprise) for hazardous waste management	MESP	2011
	3. To make an inventory of public locations, where hazardous waste materials can be generated / stored, as well as a list of quantities and types of hazardous waste	MESP, AP, SEPA, SCC	2011
	4. To build central regional storages for hazardous waste in 5 regions of Serbia	MESP	2012
	5. To build centres for the collection of hazardous household waste	MESP, AP, LSG	2010-2012
	6. To educate and promote awareness raising regarding the handling of hazardous waste	MESP, SCC	2010-2012
	7. To establish a system for POPs waste management	MESP	2012

	8. To organize collection, temporary storage and treatment of abandoned pesticides	MAFWM, MESP	2012
	9. To build temporary storages for the collection of hazardous waste materials that will be exported in order to be treated	MESP, Commercial entities	2010
	10. To establish a transportation system for hazardous waste	MI, MESP	2012
	11. To offer technical help in the building of plants for the physical-chemical treatment and disposal of waste	MESP	2011-2013
	12. To build and to put in operation a strategic plant for physical-chemical treatment and disposal of waste	MESP, Fund	2011-2013
	13. To make an inventory of locations contaminated with hazardous waste, to	MESP, Fund	2011

	define risks and priorities for rehabilitation and remediation		
	14. To rehabilitate locations contaminated with hazardous waste that pose risk for the environment	MESP, Fund, Commercial entities	2011-2013
	15. Economic instruments: to develop mechanisms to solve the problem on historical contamination, including the damages caused to the environment by the unregulated disposal of hazardous waste	MESP, MF	2011
8. To establish a management system for specific waste streams (waste tyres, used batteries and accumulators, waste oils, end-of-life vehicles, WEEE, etc.)	1. To promote formation of suitable centres for the collection of recyclable waste, where people will bring their waste	LSG, MESP, AP, Fund	2010-2011
	2. Demonstration projects: To build centres for the separate	LSG, MESP, AP, Fund, SCC	2010-2011

	collection of recyclable waste (paper, glass, plastic, tin cans, electric / electronic waste, batteries and accumulators, waste oil etc.)		
	3. To build waste oil treatment plants	MESP, LSG, AP, Fund, Commercial entities	2010-2013
	4. To build waste tyres recycling plants	LSG, MESP, AP, Fund, Commercial entities	2010-2013
	5. To build treatment plants for used batteries and accumulators	LSG, MESP, AP, Fund, Commercial entities	2010-2013
	6. To build treatment plants for WEEE	LSG, MESP, AP, Fund, Commercial entities	2010-2013
	7. To build plants for end-of-life vehicles treatment	LSG, MESP, AP, Fund, Commercial entities	2010-2013
	8. Recultivation of the existing ash landfills and use of flying ash from TPPs for road construction, building construction and in construction material industry	MESP, MME, MI, EPIS, SCC	9-2013
	9. To raise public awareness: to	MESP, AP, LSG, SCC	2010

	organise recycling campaigns, and to include the public in decision making process		
	10. Economic instruments: To introduce stimulating instruments that will encourage re-use and recycling of waste material	MESP, MF	2011
9. To establish a waste management system for medical and pharmaceutical waste	1. To draft a national program for medical waste management, to define the quantity and types of medical waste	MH, MESP, AP	2010
	2. To adopt regulations regarding medical and pharmaceutical waste handling	MH, MESP	2010
	3. To train medical staff to separate medical waste	MH, healthcare institutions	2010
	4. To draft waste management plans in all health institutions	MH, healthcare institutions	2010
	5. To procure autoclaves in order to treat infectious medical waste	MH, healthcare institutions, Commercial entities	2010

	6. To separate the infectious medical waste at source	Healthcare institutions	2011
	7. To develop feasibility study to build incinerator for hazardous medical waste	MH, MESP	2013
	1. To revise regulations that refer to animal waste in conformity with EU regulations	MAFWM	2010
	2. To make an inventory of animal waste and a feasibility study for animal waste management in Serbia	MAFWM, AP	2010
10. To establish management system for animal waste and to adopt regulation	3. To raise the level of awareness and develop a training programme for agricultural producers and slaughterhouses	MESP, MAFWM, AP	2010-2011
	4. To develop a programme for animal waste management	MAFWM, AP	2011
	5. To ensure state subventions destined to animal waste treatment plants for Categories 1	MAFWM	2011

	and 2 animal waste		
	6. To establish a system for collection and transportation of waste materials to animal waste treatment plants	MAFWM	2012
	7. To build and reconstruct animal waste treatment plants	MAFWM, Commercial entities	2011-2012
11. To promote the use of waste as an alternative source of fuel at cement plants, steel mills, thermal power plants-heating plants in conformity with the waste hierarchy principle	1. Public awareness campaign regarding the benefits of using waste as an alternative fuel and as an alternative raw material	MESP, AP, SCC, Commercial entities	2011-2013
	2. Feasibility study for the use of waste as an alternative fuel (oil, tyres, biomass etc.)	MESP, AP, Commercial entities	2010
	3. To draft technical standards for the use of waste as fuel	MESP, SIS, SCC	2010
	4. To develop existing production facilities and technology (BAT application) for the usage of waste as an alternative fuel	MESP, Commercial entities	2011
	5. To	MESP, Commercial entities	2011

	introduce gas emission monitoring in plants that use waste as alternative fuel		
	6. To use available facilities for thermal waste processing (cement plants, thermal power plants etc.)	MESP, Commercial entities	2011
12. To rehabilitate existing dumps that present the highest risk for the environment, as well as "hot spots" that have been historically contaminated by hazardous waste	1. To make a unified cadastre of waste dumpsites	SEPA	2010
	2. To define the risks and the ways to rehabilitate dumpsites, to establish rehabilitation priorities and make closing down plans	MESP, AP, LSG, Fund	2010
	3. To close, rehabilitate and recultivate existing dumpsites in conformity with priorities	MESP, AP, LSG, Fund	2012-2013
	4. To establish monitoring systems for the recultivation of high risk locations	MESP, AP, LSG	2012

Abbreviations

LSG Local Self Government
MESP Ministry of Environment and Spatial Planning

MAWF	Ministry of Agriculture, Forestry and Water Management
MME	Ministry of Mining and Energy
MH	Ministry of Health
MF	Ministry of Finance
AP	Autonomous Province
SEPA	Environment Protection Agency
Fund	Environment Protection Fund
SIS	Standardization Institute of Serbia
SCC	Serbian Chamber of Commerce
EPIS	Electric Power Industry of Serbia
PUC	Public Utility Companies

12. THE STRATEGY PUBLICATION

This Strategy shall be published in the “Official Gazette of the Republic of Serbia”.

APPENDIX 1
ANALYSIS OF THE IMPLEMENTATION OF MEASURES AND ACTIVITIES DEFINED IN THE NATIONAL WASTE MANAGEMENT STRATEGY 2003-2008

1. Legislative measures			
	Activities / measures	**Deadline**	**Implementation**
1	Adoption of the Law on Environment Protection	Early 2003	adopted in 2004
2	Preparation and adoption of the Law on Waste Management	2003/2004	adopted in 2009
3	Preparation of the Law on Packaging and Packaging Waste	2004	adopted in 2009
4	Revision and harmonisation of current secondary legislation	2004	on-going
5	Rulebook on criteria for determining locations of landfills	2003	no
6	Revision of current resolutions on municipal activities	2004	no
7	Adoption of technical standards for specific waste types (municipal/industrial/commercial/hazardous/medical etc.)	2005	no
8	Introduction of responsibility of manufacturer for processing/recycling	2005	In the Law on Waste Management

	of certain kinds of products (packaging, electronic devices, unusable vehicles and others)		
9	Preparation of proposal for introduction of different fees for different waste management methods/services	2004	no

2. Institutional and organisational measures			
	Activities / measures	**Deadline**	**Implementation**
1	Establishment of inter-ministerial Committee for coordination of the implementation of Waste Management Strategy	Mid 2003	no
2	Determination of primary and secondary responsibility in regulations	Mid 2003	yes
3	Define in detail the responsibilities at level of state, autonomous province and local level	In preparatory phase of each law	yes
4	Establishment of cooperation and responsibility of multiple adjacent municipalities for planning of waste management at inter-municipal level	Upon the adoption	16 regions have signed the agreements and started preparation of technical documentation for the construction of landfills
5	Introduction of mandatory competitive bidding for execution of municipal services (in line with the Law on Public Procurement)	2003	yes
6	Developing the model of tender and contract for execution of waste management services (in line with the Law on Public Procurement)	2003	yes
7	Incorporation of the EU and national standards and aims into the scope of long-term contracts for waste management	2005-2015	no
8	Inclusion of separate collection of recyclable materials (including biodegradable materials) in regional/municipal plans and contracts for rendering municipal waste collection services	2005-2015	on-going
9	Establishment of independent professional organization (association, society or chamber) for all participants in waste management	since 2003	no
10	Upgrading of introduction of Environmental Management System	2003/2004	no

	(ISO and EMAS scheme) and Eco-labelling scheme		
11	Inclusion of integrated transport system into regional waste management plans	2004-2009	Planned once regional landfill becomes operational

3. Technical/Operational measures			
	Activities / Measures	**Deadline**	**Implementation**
1	Organising collection station for admittance of bulk/hazardous/recyclable household waste	2004	No, except for individual initiative in some local self-government units
2	Construction of “collection centres” for recyclable materials where citizens can bring waste themselves	2004-2007	No, except for individual initiative in some local self-government units
3	Closure of the existing dumps from category K4	2006	on-going, with financial support from the Fund, AP Vojvodina, municipality, NIP
4	Rehabilitation of the existing landfills, improvement of status and setting up of long-term monitoring (until the construction of regional facilities)	2010	
5	Recultivation of all already closed dumps	2005	
6	Construction of regional facilities for acceptance, packing, marking and temporary storage of potentially hazardous waste assigned for treatment in Serbia or transboundary export for treatment /return	End of 2004	no
7	Construction of regional facilities for separate collection, treatment and disposal of medical waste	2005	on-going, the EU project
8	Construction of national facility for high-temperature incineration of combustible hazardous waste	2005	no
9	Construction of national facility for physical-chemical treatment and stabilization of non-flammable hazardous waste	2005	no
10	Construction of facility for acceptance/processing of used oils, old tyres, spent batteries and accumulators, end-of-life vehicles and electric/electronic equipment	2004	Initiative of private sector, obligation pursuant to the new Law
11	Construction of facility for acceptance/processing/recycling of biodegradable waste (composting)	2009	no
12	Construction of facility for processing of collected and separated packaging material at source	2004	no
13	Construction of facility for treatment/stabilization of sewage sludge	2004	no
14	Construction of regional landfills for disposal of previously treated, non-inert, non-hazardous waste	2010	no

	in line with EU standards /best practice		
15	Construction of new safe landfill for disposal of certain (stabilised) hazardous waste	End of 2004	no
16	Construction of facility for incineration of municipal waste	2010	no
17	Construction of transfer stations	2003-2010	on-going
18	Use of cement plants and steel mills for incineration of hazardous waste, i.e. use of alternative fuels from waste along with system development for gas refinement in line with EU standards	2005	co-incineration of waste tyres is performed in two cement plants (Holcim and Lafarge)
19	Analysis of possibility to use existing facilities for treatment of hazardous waste	2003.	no
20	Rehabilitation of existing storages of hazardous waste up to the level of minimum conditions required for environmental protection	2005	no
21	Use of abandoned open cast ore and coal mines for depositing of mine and flotation tailings, as well as of ash from thermal power plants. At internal disposal sites of abandoned pits the deposited ash should be covered with mine tailings	2005	no
22	Increased use of ash from thermal power plants as secondary raw material (cement plants, construction material). In best case, in this way it is possible to place and use around two million tonnes of generated ash in Serbia per year.	2007	no
23	Replacement of all plants with PCB/PCT oils, decontamination of plants, destruction of all hazardous waste materials with PCB/PCT	2015	no
24	Construction of facility for recycling of construction waste	2007	no
25	Closure of conditionally dirty technologies and switch to clean ones	2010	no
26	Remediation of contaminated soil	2008	Remediation in south Serbia from depleted uranium finished in 2006
27	Reconstruction of the existing open rendering facilities	2005	Partially done
28	Construction of new rendering facilities	2008	no

4. Economic measures			
	Activities / Measures	**Deadline**	**Implementation**
1	Implement new method to determine price of services	2003	no

2	Increase level of fines for improper waste treatment	2003	no
3	Improve system of supervision, control, imposition of penalty and collection of fines, including establishment of municipal police	2004	no
4	Further develop the packaging return system that should cover the widest product range possible	2004	no
5	Establish the system of extended responsibility of manufacturers aimed at setting up the system fully compliant to EU	2005	In the Law on Waste Management and the Law on Packaging and Packaging Waste
6	Commence the restructuring of public utility companies, in terms of their direct linking to founders, perform division into organizational and technical wholes, spinning-off of non-core activities, and corporatize them	2004	no
7	Start granting concessions to private and mixed companies, primarily, for activities of collection and disposal of waste	2005	Joint companies between local and foreign partners Kikinda, Leskovac, Novi Bečej, Kovačica, Jagodina, Lapovo and others
8	Perform liberalisation of the sector, introduce competition and right of user to choose the most favourable service provider, and deregulate prices	2005	no
9	Privatise the activities related to waste management, wherever justified	2005	No, except for public-private partnership for collection in municipalities of Knjaževac, Malo Crniće, Žabari

5. Public awareness raising			
	Activities / Measures	**Deadline**	**Implementation**
1	Introduction of formal legal mechanism such as acquiring qualifications and professional standards into the waste management field	2005	no
2	Acquiring and improving of education and training of waste managers, technologists and operation staff	2005	no
3	Establishment of national authority in charge of development of education programmes and training	2003	no
4	Development and implementation of a programme for continuous communication with all participants in waste management, particularly with generators	permanent	no

Appendix 2

REGULATIONS RELEVANT FOR WASTE MANAGEMENT

1) Environmental Protection Law ("Official Gazette of the Republic of Serbia", No. 135/04, 36/09, 36/09-oth. law and 72/09-oth.law) on the basis of which the following bylaws have been adopted:

- By-law on the requirements to be fulfilled by competent organizations for waste testing ("Official Gazette of the Republic of Serbia", No. 53/06);
- Regulation on the type of pollution, the criteria for calculation of charges for environmental pollution and payers, the amount of charges and manner of charge calculation and payment ("Official Gazette of the Republic of Serbia", No. 113/05, 6/07 and 8/10) stipulating the liability to pay the charge for environmental pollution according to the type, amount or characteristics of emission from specific sources, i.e. type, amount or characteristics of emission of generated or disposed waste, as well as according to the quantity of materials harmful to environment in raw materials, semi-products or products;
- Regulation on the measures and conditions for return, exemption or reduction of a charge for environmental pollution ("Official Gazette of the Republic of Serbia", No. 113/05);
- Rulebook determining consolidated amounts of charge for environmental pollution ("Official Gazette of the Republic of Serbia", No. 7/09) regulating annual amounts of charges for, inter alia, disposed non-hazardous industrial waste and generated hazardous waste;
- Rulebook on the methodology for the elaboration of the integral cadastre of polluters ("Official Gazette of the Republic of Serbia", No. 94/07);
- Rulebook on more detailed conditions and procedure for obtaining the right to utilise ecological label, the elements, layout and manner of utilisation of ecological label for products, processes and services ("Official Gazette of the Republic of Serbia", No 3/09);

Till the adoption of new bylaws, the following shall be applied:

- By-law on the methodology for the estimation of chemical accident and environmental pollution hazard, the measures for preparation and measures for consequences elimination ("Official Gazette of the Republic of Serbia", No 60/94) which stipulates the methodology for assessment of danger and/or risk of chemical accident and environment pollution, the preparation measures for possible chemical accident and measures for elimination of chemical accident consequences, as well as the manner of maintaining the register of types and quantities of hazardous materials in production, utilisation, transport, trading, storage and disposal;

2) **Law on Environmental Impact Assessment** ("Official Gazette of the Republic of Serbia", No. 135/04 and 36/09) on the basis of which the following bylaws have been adopted:

- Regulation on the establishment of the List of projects for which the impact assessment is mandatory and the List of projects for which the environmental

impact assessment may be required ("Official Gazette of the Republic of Serbia", No.114/08);

- Rulebook on the content of the application for the impact assessment need, and the content of the application for the establishment of the scope and content of the study on environmental impact assessment (**"**Official Gazette of the Republic of Serbia", No. 69/05);
- Rulebook on the content of the study on environmental impact assessment (**"**Official Gazette of the Republic of Serbia", No. 69/05);
- Rulebook on the activities of the technical commission for evaluation of the environmental impact assessment study (**"**Official Gazette of the Republic of Serbia", No. 69/05);
- Rulebook on the procedure of public insight, presentation and public discussion on the environmental impact assessment study (**"**Official Gazette of the Republic of Serbia", No. 69/05);
- Rulebook on the content, layout and method of maintaining the public register on conducted procedures and rendered decisions on environmental impact assessment (**"**Official Gazette of the Republic of Serbia", No. 69/05);

3) **Law on Integrated Pollution Prevention and Control** (**"**Official Gazette of the Republic of Serbia", No. 135/04) according to which the following bylaws have been adopted:

- Regulation on types of activities and plants for which the integrated permit is issued (**"**Official Gazette of the Republic of Serbia", No. 84/05);
- Regulation on the criteria for determining the best available techniques, application of quality standards, as well as limit values of emission in the integrated permit (**"**Official Gazette of the Republic of Serbia", No. 84/05);
- Regulation on the content of the program of measures for adjustment of existing facility operations or activities to the prescribed conditions (**"**Official Gazette of the Republic of Serbia", No. 84/05);
- Rulebook on the content, layout and method of maintaining the register of issued integrated permits (**"**Official Gazette of the Republic of Serbia", No. 69/05);
- Rulebook on the content, layout and method of filling in the application for integrated permit (**"**Official Gazette of the Republic of Serbia", No. 30/06);
- Rulebook on the content and layout of the integrated permit (**"**Official Gazette of the Republic of Serbia", No. 30/06);
- Regulation on the establishment of the Program of dynamics of application for integrated permits (**"**Official Gazette of the Republic of Serbia", No. 108/08);

4) **Law on Utility Services** ("Official Gazette of the Republic of Serbia", No. 16/97 and 42/98) determines utility services and regulates general conditions and manner of their provision, enable organisation and provision of utility services for two or more municipalities and/or towns, under the conditions stipulated by the law and agreement among the municipal assemblies;

5) **Law on Chemicals** (**"**Official Gazette of the Republic of Serbia", No. 36/09) regulates integrated management of chemicals, classification, packaging and labelling of chemicals, the integrated chemical register and register of chemicals placed on the market, restrictions and prohibitions for production, placement on the market and use of chemicals, import and export of certain hazardous chemicals, permits for trading

operations and permits for utilisation of particularly hazardous chemicals, placement of the detergents on the market, systematic monitoring of chemicals, availability of data, surveillance and other issues of importance for chemical management. From the day this law entered into force, the **Law on production and placement on the market of toxic substances** (**"**Official Gazette of the Federal Republic of Yugoslavia", No.15/95, 28/96 and 37/02 and **"**Official Gazette of the Republic of Serbia", No. 101/05 and 36/09-oth.law) ceased to be valid, except for the provisions on sorting and exploration of toxic agents that shall apply exclusively on the plant protection products, until the day the law determining the plant protection products enters into force. Until new bylaws are adopted, the following shall apply:

- Decision on labelling the toxic agents placed on the market (**"**Official Gazette of the Federal Republic of Yugoslavia", No. 38/97);
- Rulebook on the criteria for classification of toxic agents into groups and methods for determining the degree of toxicity of certain toxic agents (**"**Official Gazette of the Socialist Federal Republic of Yugoslavia", No. 79/91);

6) **Law on Transport of Hazardous Substances** (**"**Official Gazette of the Socialist Federal Republic of Yugoslavia", No. 27/90 and 45/90, **"**Official Gazette of the Federal Republic of Yugoslavia", No. 24/94, 28/96, 21/99, 44/99 and 68/02 and **"**Official Gazette of the Republic of Serbia", No. 36/09) stipulates the conditions for the transport of hazardous substances and the manner of preparation of hazardous substances for transportation, loading and unloading and other manipulations, the prohibition of import of hazardous waste of foreign origin for temporary or permanent disposal, and establishes the responsibility of insuring hazardous materials during transportation in case of damage inflicted to third parties. *From the day the Law on Chemicals enters into force (**"**Official Gazette of the Republic of Serbia", No. 36/09), the provisions of Article 51 of this Law concerning the permit for transportation of toxic agents across the state border (import, export and transit) shall cease to be valid;*

7) **Law on Biocidal Products** (**"**Official Gazette of the Republic of Serbia", No. 36/09) sets forth the lists of active substances, the procedures for adoption of acts determining the placement of biocidal products on the market, the restrictions and prohibitions of exploitation and placement the biocidal products on the market, the research and development of biocidal products, the classification, packaging, labelling, advertising and safety data sheet of a biocidal product, the register of biocidal products, the safe utilisation of biocidal products, monitoring and other areas of concern for safe utilisation and placement of biocidal products on the market;

8) **Law on Air Protection** (**"**Official Gazette of the Republic of Serbia", No.36/09) regulates air quality management, and stipulates the measures, the manner of organization and control of implementation of protection and promotion of the quality of air as a natural value of common interest under special protection. The provisions of this Law shall not apply to pollutions caused by radioactive materials, industrial accidents and natural disasters. Until new bylaws are adopted, the regulations passed on the basis of the priory valid Law on Environmental Protection shall be valid:

- Regulation on limit values of emission, the method and time limits for measuring and recording the data (**"**Official Gazette of the Republic of Serbia", No.30/97 and 35/97) determines limit values of the emission of harmful and hazardous substances into the air

on the site of the pollution source, the manner and time limits for measuring and recording the data on conducted measurements;

- Regulation on limit values, methods of immission measurement, criteria for the establishment of measuring points and data record (**"**Official Gazette of the Republic of Serbia", No. 54/92, 30/99 and 19/06) stipulates limit values of immission, warning immissions, periodic air pollution, the methods of systematic immission measurement, the criteria for the establishment of measuring points and method of data record and impact of polluted air on the human health;

9) **Law on Plant Health** (**"**Official Gazette of the Republic of Serbia", No. 41/09), by whose entry into force the Law on Plant Protection ceased to be valid ("Official Gazette of the FRY", No. 24/98, 26/98 – correction, "Official Gazette RS" No.101/05 – other law and 41/09-other law) regulates the method of manipulation of plant harmful organisms, seized consignments of pesticides and fertilisers, including their destruction. The following bylaws shall apply:

- Rulebook on the method of plant destruction designated to be destroyed ("Official Gazette of the FRY, No. 67/01);
- Rulebook on the types of packaging for pesticides and fertilisers and destruction of pesticides and fertilisers ("Official Gazette of the FRY", No.35/99 and 63/01).

10) **Veterinary Medicine Law** (**"**Official Gazette of the Republic of Serbia", No. 91/05) regulates the protection and promotion of animal health and welfare, determines animal infectious diseases and measures for the prevention of occurrence, detection, prevention of spreading, control and elimination of animal infectious diseases and diseases that can be passed from animals to humans, the veterinary-sanitary control and requirements for breeding and trading in animals, the production and trading in products of animal origin, foods of animal origin, food for animals, the requirements for veterinary practice, as well as the method of safe disposal of animal corpses and animal waste. The bylaws passed on the basis of this Law are:

- Rulebook on the method of safe disposal of animal corpses and animal waste and on the requirements to be met by establishments and equipment for collecting, safe disposal and determining the cause of animal death, and transportation means for the shipment of animal corpses and animal waste ("Official Gazette of the SFRY", No. 53/89)
- Rulebook on the method of safe disposal and utilisation of animal corpses ("Official Gazette of the SRS", No. 7/81);
- Rulebook on the requirements to be met by establishments where safe elimination and processing of animal corpses, slaughterhouses confiscate and blood is conducted ("Official Gazette of the SRS", No.7/81);

11) **Medicines and Medical Products Law** ("Official Gazette of the Republic of Serbia", No. 84/04, 85/05 and 36/09-other law) stipulates the conditions for the production, trade in and testing of medicines and medical products used in human and veterinary medicine, the monitoring in these areas, the establishment of the Agency for Medicines and Medical Products of Serbia, permitting conditions and procedure for placing the medicines and medical products and other issues of importance on the market. *By entry into force of the Law on Waste Management ("Official Gazette of the Republic of Serbia",*

No. 36/09), Article 82, paragraph 1 of this Law ceased to be valid, and until new bylaws are passed in the field of waste management, the following shall be applied:

- Rulebook on the method of destruction of medicines, auxiliary medicinal products and medical products ("Official Gazette of the FRY", No. 16/94 and 22/94);

12) **Law on Sanitary Surveillance** ("Official Gazette of the Republic of Serbia", No. 125/04) regulates the method of and procedure for conducting sanitary surveillance, defines areas and establishments subject to sanitary surveillance and the sanitary requirements to be met by establishments;
13) **Law on Health Care** ("Official Gazette of the Republic of Serbia", No. 107/05 and 72/09) regulates the healthcare system, the organization of health service, the social care for the population health, general interest in health care, the rights and obligations of patients, health care for foreign citizens, the establishment of the Agency for Accreditation of Health Institutions in Serbia, the surveillance and other issues of importance to organisation and implementation of health care. The scope of social concern for the health of the population includes, *inter alia*, the responsibility to adopt state program in the area of health care concerning the polluted environment which has resulted from the presence of harmful and hazardous substances in the air, water and soil, disposal of waste materials, hazardous chemicals etc. The responsibility of health institutions and private practice to organise, i.e. to provide measures for disposal and/or destruction of medical waste in conformity with the law has been established as well.
14) **Law on Standardisation** ("Official Gazette of the Republic of Serbia", No. 36/09) stipulates the principles and objectives of standardisation, establishment, organisation and operation of standardisation organisation, the adoption, issuance and application of Serbian standards and related documents in the field of standardisation. Serbian standards (SRPS EN) concerning specific requirements for placing the packaging on the market apply in Serbia, and these are the following:

- Identification of critical regions for the reduction of used raw materials (SRPS EN 13428)
- Methodology for determining the concentration of heavy metals, depending on packaging material or its component (SRPS EN 13695-1)
- Identification of the presence of hazardous materials in the package or the components thereof, and the possibility of their presence in the emission, ashes and leachate water from landfills. (SRPS EN 13428 and 13695-2)
- Requirements for minimisation if hazardous materials have been identified in the packaging or its component that can be released into the environment (SRPS EN 13695-2, subsection 7)
- Presentation of harmonisation with the minimisation requirement (SRPS EN 13695-2, subsection 8, SRPS EN 13428, appendix C)
- Identification of the most appropriate system of recoverable use for certain type of packaging (SRPS EN 13429)
- Assessment of packaging harmonisation with the requirements for reusable packaging (SRPS EN 13429)
- Criteria for packaging suitable for recycling (SRPS EN 13430)
- Methodology for the assessment of harmonisation of packaging with the requirements of certain criteria (SRPS EN 13430)
- Methodology for the assessment and evaluation of suitability of packaging for biodegradation and composting (SRPS EN 13432)

- Methodology for the assessment of harmonisation of the packaging reusable in the form of energy (SRPS EN 13431) and procedure for the application of that methodology (SRPS EN 13427)
- Packaging – Labelling and material identification system (SRPS CR 14311)

15) **Planning and Construction Law** ("Official Gazette of the Republic of Serbia", No. 72/09) determines the conditions and method of spatial planning, arrangement and utilisation of construction land and development and utilisation of buildings;
16) **Law on Waters** ("Official Gazette of the Republic of Serbia", No. 46/91, 53/93, 67/93, 48/94, 54/96 and 101/05) regulates water management conditions and water management consent for specific industrial facilities discharging wastewaters; regulates the obligation of construction of wastewater treatment plant and facilities for disposal and discharge of wastewater, including industrial and municipal landfills. The bylaws based on this Law are the following:

- Rulebook on hazardous substances in waters ("Official Gazette of the Republic of Serbia", No. 31/82);
- Rulebook on the method and minimal number of wastewater quality tests ("Official Gazette of the Republic of Serbia", No. 47/83 and 13/84);

17) **Law on Agricultural Land** ("Official Gazette of the Republic of Serbia", No. 62/06 and 65/08 – other law and 41/09) regulates the protection of land, as well as the conditions for land utilisation for mineral raw materials exploitation and disposal of tailing, ashes and slag and other waste and hazardous substances on agricultural land and stipulates the obligation of recultivation of agricultural land utilised for disposal of tailing, ashes and slag or other waste material;
18) **Law on Mining** ("Official Gazette of the Republic of Serbia", No. 44/95, 85/05, 101/05, 34/06 and 104/09);
19) **Law on Energy** ("Official Gazette of the Republic of Serbia", No. 84/04);
20) **Law on Geological Researches** ("Official Gazette of the Republic of Serbia", No. 44/95 and 101/05) stipulates the conditions and method of implementation of geological researches;
21) **Law Determining Competencies of the Autonomous Province of Vojvodina** ("Official Gazette of the Republic of Serbia", No. 99/09) determines the competencies of the autonomous province, particularly in the areas where the system is regulated by the Republic, such as the following: culture, education, health care, sanitary inspection, protection and improvement of the environment, urban planning, construction, economy and privatisation, mining and power industry, agriculture, forestry etc.;
22) **Local Self-Government Law** ("Official Gazette of the Republic of Serbia", No. 129/07) stipulates the rights and responsibilities of a local self-government unit stipulated by the Constitution, law, other regulation and statute (main and entrusted affairs), the possibility of cooperation and association of the local self-government units aiming at fulfilment of mutual objectives, plans and development programmes, as well as other needs of common interest;
23) **Law on Funding of Local Self-government** ("Official Gazette of the Republic of Serbia", No. 62/06) regulates the manner of funding of local self-government units from the source revenue and conceded public revenues of the Republic;
24) **Capital City Law** ("Official Gazette of the Republic of Serbia", No. 129/07) regulates the position, competences and authorities of the City of Belgrade, the capital city of the Republic of Serbia;

25) **Law on Public Enterprises and Business Activities of General Concern** ("Official Gazette of the Republic of Serbia", No. 25/00, 25/02, 107/05, 108/05 and 123/07) regulates the establishment and business operation of the enterprises that perform activities of general concern, the form and share of the state capital in a public enterprise, and defines an activity of general concern as activities that are stipulated by law as such and that are, *inter alia*, in the field of utilization, management, protection and promotion of assets of general concern, as well as utility services.
26) **Law on Commercial Entities** ("Official Gazette of the Republic of Serbia", No. 125/04) regulates the founding of commercial entities and entrepreneurs, the managing of commercial entities, the rights and obligations of founders, partners, members and shareholders of commercial entities, the linking and reorganization (status changes and changes of legal form, reorganization), the cessation of business of entrepreneurs and the liquidation of commercial entities, as well as the conditions for the performance of the activities, i.e. the obligation to obtain the decision of a competent authority regarding the fulfilment of the conditions of technical equipment, work safety and environmental protection and improvement, particularly for commercial entities performing the activities of production, trade, distribution, processing and storage of hazardous and harmful materials. Article 6 prescribes that a commercial entity may perform business activities in premises which meet requirements regarding technical equipment, occupational safety and environmental protection and promotion, as well as other prescribed requirements (paragraph 1). The fulfilment of the conditions referred to in paragraph 1 of this article shall be verified by a competent authority in the regular inspection procedure (paragraph 2). A commercial entity may initiate the performance of the activities including the production, trade, distribution, processing and storage of materials hazardous and harmful to human health and environment, should a competent authority by a decree certify that the conditions referred to in paragraph 1 of this Article have been met (paragraph 3);
27) **Foreign Trade Law** ("Official Gazette of the Republic of Serbia", No. 36/09) regulates foreign trade operations in conformity with the regulations of the World Trade Organization and regulates, *inter alia*, the conditions for import and export of goods, enables the prescription of special criteria for the placement on the market of specific goods for the purpose of the protection of life, health and safety of humans, plants and animals, as well as the environment;
28) **Concession Law** ("Official Gazette of the Republic of Serbia", No. 55/03) regulates the conditions, method and procedure of concession for utilisation of natural resources, assets in general use legally determined to be in possession of the Republic of Serbia and operations of general concern such as the construction, maintenance and utilisation of utility buildings for the purpose of executing utility activities, the concession period, the procedure of granting concession by a concession act and public tender, as well as the concession remuneration, exercising of concession rights and liabilities, foundation and operation of a concession company;
29) **Law on the Privatisation** ("Official Gazette of the Republic of Serbia", No. 38/01, 18/03, 45/05 and 123/07) stipulates the requirements and procedure for transfer of ownership of public or state-owned capital; designates that from the resources generated from the sale of capital, resources amounting to 5% be allocated to the local community where the head office of the privatization subject is situated, and that the resources generated from the sale of the capital may be used for special programs of development of economy and environment protection adopted by the local self-government authority. In addition, it has been prescribed that the resources for the elimination of the damage inflicted by the privatization entity to the environment prior to

the conclusion of the contract concerning the sale of the capital and/or property be provided from the budget of the Republic of Serbia;

30) **Law on Private Entrepreneurs** ("Official Gazette of the SRS", No. 54/89 and 9/90, ("Official Gazette of the Republic of Serbia", No 46/91, 53/93, 67/93, 48/94, 53/95, 35/02, 55/04 and 101/05) stipulates the requirements and procedure for the initiation of execution of certain operations for which an entrepreneur acquires appropriate evidence and documentation. In Article 11, it is stipulated that the entrepreneur can execute the operations in the premises meeting the prescribed conditions (paragraph 1). Prior to the initiation of operations: the production, trade, distribution, processing, disposal and storage of hazardous, harmful ad waste materials, nuclear energy, oil and oil derivatives, toxic agents, medicines, narcotics and auxiliary medical products, medical products and equipment emitting ionizing radiations, chemicals, adhesives, solvents, paints, products for disinfection, insect and rodent control and raw leather, the production and bottling of drinking water, rendering of health care services in stationary conditions and other forms of health care provision, the industrial production of food products, marketing of fresh meat and catering, the entrepreneur is obliged to obtain the act of a competent authority concerning the fulfilment of the prescribed conditions in the view of safety and workplace safety, environmental protection, sanitary and health conditions and technical as well as other prescribed conditions (paragraph 2). For the business operations not stated in paragraph 2 of this Article, the competent authorities shall determine the fulfilment of the required conditions in the procedure of regular inspection over the execution of these operations;

31) **Customs Law** ("Official Gazette of the Republic of Serbia", No. 73/03, 61/05, 85/05, 62/06 and 9/10) regulates the customs territory; border zone, border crossing, customs goods, surveillance and control, benefits, procedure for import, export and transit of goods, rights and obligations of customs authorities and participants in the customs procedure;

32) **Customs Tariff Law** ("Official Gazette of the Republic of Serbia", No. 62/05, 61/07, 112/07, 9/08, 111/08, 5/09, 10/09 and 100/09) stipulate the Customs Tariff; the rules for calculating customs duties; the description system of goods which are imported, carried in or received into the customs territory of the Republic of Serbia, or which are exported, carried out or sent from the customs territory of the Republic of Serbia, classified into sections and chapters of the Customs Tariff; the numerical system for designating the goods (tariff headings, tariff subheadings and tariff positions) in the Customs Tariff; as well as the rules for classifying the single items of goods into tariff headings, tariff subheadings and tariff positions of the Customs Tariff;

33) **Criminal Code** ("Official Gazette of the Republic of Serbia", No.85/05, 88/05 and 107/05) sanctions: the transfer of goods across the customs border avoiding the measures of customs surveillance; the sale, distribution or concealment of uncleared goods; illicit production or processing of goods without the approval of a competent authority; illicit trade, production, sale or marketing of harmful food products, food or drinks or other harmful products; pollution of drinking water or food products; the breach of regulations concerning the protection, preservation and promotion of the environment by air, water and soil pollution; failure to undertake designated environmental protection measures; illegal construction, in case that authorized or competent person approves the construction, operation or exploitation of facility or the application of the technology polluting the environment, thus acting against the regulations on the environmental protection, preservation and promotion; damage to the facilities and equipment for the environmental protection; damage to the environment due to the breach of the regulations; exploitation of natural resources, construction of facilities, execution of works or some other manner of inflicting damage to the environment; destruction,

damage to and carrying of a protected natural asset across the border; carrying hazardous materials in Serbia and illicit processing, disposal and storage of hazardous material; illicit construction of nuclear plants; violation of right to be informed on the state of environment (denial of information or presenting false information); forest devastation (falling or disafforestation, or tree damaging or any other manner of forest devastation of falling of one or more trees in a park, line of trees or any other place where tree falling is illicit); illicit hunting; illicit fishing; damage to dams and water facilities, destruction and damage to public equipment; illicit manipulation of explosive and inflammable material; illicit acquisition of nuclear material and jeopardizing of safety by nuclear material etc.

34) **Taxation laws** of the Republic of Serbia which regulate the object of taxation, taxpayers, conditions and manner of tax payment, as well as specific incentives, include the following:

- **Enterprise Profit Tax Law** ("Official Gazette of the Republic of Serbia", No. 25/01, 80/02, 43/03 and 84/04);
- **Individual Income Tax Law** ("Official Gazette of the Republic of Serbia", No. 24/01, 80/02, 135/04, 62/06, 65/06, 10/07, 7/08, 7/09, 31/09, 44/09 and 3/10);
- **Value Added Tax Law** ("Official Gazette of the Republic of Serbia", No.84/04, 86/04, 61/05 and 61/07);

- **Property Tax Law** ("Official Gazette of the Republic of Serbia", No.26/01, 42/02, 45/02, 80/02, 135/04, 61/07 and 5/09);

- **Excise Tax Law** ("Official Gazette of the Republic of Serbia", No. 22/01, 42/01, 61/01, 73/01, 5/02, 24/02, 45/02, 69/02, 80/02, 15/03, 43/03, 56/03, 72/03, 93/03, 2/04, 31/04, 43/04, 51/04, 55/04, 78/04, 116/04, 135/04, 8/05, 46/05, 47/05, 58/05, 71/05, 101/05, 112/05, 3/06, 11/06, 12/06, 66/06, 10/07, 61/07, 18/08, 5/09, 9/09, 31/09 and 3/10).

Appendix 3
AMOUNT OF MUNICIPAL WASTE GENERATED ANNUALLY IN SERBIA AND ESTIMATED AMOUNTS FOR 2020

	Local self-government	Population as per 2002 census	Amount of generated waste 2009, t	Estimated amounts for 2020, t
Severnobački county				
1.	Subotica	148.401	61.402	87.190
2.	Bačka Topola	38.245	9.352	13.279
3.	Mali Idjoš	13.494	2.833	4.023
Zapadnobački county				
4.	Sombor	97.263	13.873	19.699
5.	Apatin	32.813	13.714	19.475
6.	Kula	48.353	20.210	28.698
7.	Odžaci	35.582	8.700	12.355

Južnobački county				
8.	Novi Sad - grad	299.294	130.000	184.600
9.	Bač	16.268	3.415	4.850
10.	Bačka Palanka	60.966	25.481	36.184
11.	Bački Petrovac	14.681	3.082	4.376
12.	Beočin	16.086	6.723	9.547
13.	Bečej	40.987	10.015	14.221
14.	Vrbas	45.852	11.212	15.921
15.	Žabalj	27.513	5.777	8.203
16.	Srbobran	17.855	3.755	5.332
17.	Titel	17.050	3.580	5.083
18.	Temerin	28.275	6.194	8.795
19.	Sremski Karlovci	8.839	3.694	5.246
Severnobanatski county				
20.	Kikinda	67.002	16.384	23.265
21.	Novi Kneževac	12.975	2.025	2.876
22.	Senta	25.568	5.368	7.623
23.	Ada	18.994	3.988	5.663
24.	Kanjiža	27.510	5.776	8.202
25.	Čoka	13.832	2.904	4.124
Srednjebanatski county				
26.	Zrenjanin	132.051	54.637	77.584
27.	Žitište	20.399	4.283	6.082
28.	Nova Crnja	12.705	2.667	3.802
29.	Novi Bečej	26.924	6.583	9.348
30.	Sečanj	16.377	3.438	4.883
Južnobanatski county				
31.	Alibunar	22.954	4.189	5.949
32.	Bela Crkva	20.367	4.276	6.0727
33.	Vršac	54.369	22.495	31.943
34.	Kovačica	27.890	5.856	8.316
35.	Kovin	36.802	7.727	10.973
36.	Opovo	11.016	2.313	3.284
37.	Pančevo	127.162	52.614	74.712
38.	Plandište	13.377	2.808	3.988
Sremski county				
39.	Inđija	49.609	20.588	29.235
40.	Irig	12.329	2.588	3.676
41.	Pećinci	21.506	4.515	6.412
42.	Ruma	60.006	14.673	20.836
43.	Sremska Mitrovica	85.902	21.005	29.827

44.	Stara Pazova	67.576	28.244	40.107
45.	Šid	38.973	9.530	13.532
City of Belgrade				
46.	Grad Beograd - Voždovac, Vračar, Zvezdara, Zemun, Novi Beograd, Palilula, Rakovica, Savski venac, Stari grad, Čukarica	1.392.691	780.000	1.107.600
47.	Grad Beograd - Barajevo, Grocka, Lazarevac, Obrenovac, Mladenovac, Sopot, Surčin	210.170	117.707	167.145
Kolubarski county				
48.	Valjevo	94.752	21.131	30.006
49.	Lajkovac	16.380	3.653	5.187
50.	Ljig	13.783	3.073	4.364
51.	Mionica	15.870	1.595	2.265
52.	Osečina	14.208	1.428	2.028
53.	Ub	31.014	6.916	9.821
Mačvanski county				
54.	Bogatić	31.941	3.211	4.560
55.	Vladimirci	19.445	1.955	2.766
56.	Koceljeva	14.866	3.315	4.707
57.	Krupanj	19.032	1.913	2.717
58.	Loznica	84.725	18.895	26.831
59.	Ljubovija	15.873	3.540	5.026
60.	Mali Zvornik	13.521	3.015	4.281
61.	Šabac	123.155	27.465	39.000
Zlatiborski county				
62.	Arilje	19.443	4.336	6.517
63.	Bajina Bašta	28.315	6.314	8.967
64.	Kosjerić	13.183	3.772	5.357
65.	Nova Varoš	18.983	1.908	2.710
66.	Požega	31.117	6.939	9.854
67.	Priboj	29.070	2.922	4.150
68.	Prijepolje	40.178	11.498	16.327
69.	Sjenica	28.048	3.123	4.434
70.	Užice	81.323	23.303	33.090
71.	Čajetina	15.412	3.437	4.880
Moravički county				
72.	Gornji Milanovac	46.092	13.191	18.731
73.	Ivanjica	34.279	3.816	5.420
74.	Lučani	23.189	2.582	3.666
75.	Čačak	116.534	33.392	47.417

Šumadijski county				
76.	Aranđelovac	47.522	13.600	19.312
77.	Batočina	11.841	1.190	1.690
78.	Knić	15.282	4.373	6.210
79.	Kragujevac	185.000	52.945	75.182
80.	Lapovo	7.905	794	1.128
81.	Rača	12.200	1.226	1.741
82.	Topola	25.292	2.542	3.610
Raški county				
83.	Vrnjačka Banja	26.481	5.905	8.386
84.	Kraljevo	120.304	34.473	48.951
85.	Novi Pazar	92.471	10.296	14.621
86.	Raška	26.077	2.903	4.123
87.	Tutin	31.428	3.499	4.969
Rasinski county				
88.	Aleksandrovac	28.218	2.837	4.028
89.	Brus	17.692	1.778	2.525
90.	Varvarin	19.157	5.482	7.785
91.	Kruševac	129.370	37.024	52.574
92.	Trstenik	46.758	5.206	7.393
93.	Ćićevac	10.157	1.021	1.450
Pomoravski county				
94.	Despotovac	24.321	6.960	9.883
95.	Jagodina	70.204	20.091	28.530
96.	Paraćin	57.306	16.400	23.288
97.	Rekovac	12.388	1.245	1.768
98.	Svilajnac	24.908	7.128	10.122
99.	Ćuprija	32.577	7.265	10.316
Braničevski county				
100.	Veliko Gradište	20.081	2.018	2.866
101.	Golubac	9.392	1.045	1.485
102.	Žabari	12.427	1.249	1.774
103.	Žagubica	14.205	1.581	2.246
104.	Kučevo	17.825	1.792	2.544
105.	Malo Crniće	13.257	1.332	1.892
106.	Petrovac	33.265	3.344	4.749
107.	Požarevac	75.118	21.525	30.565
Podunavski county				
108.	Velika Plana	43.471	4.840	6.873
109.	Smederevo	109.379	31.342	44.506
110.	Smederevska Palanka	54.367	15.559	22.094

Borski county				
111.	Bor	55.817	6.215	8.825
112.	Kladovo	22.640	2.520	3.579
113.	Majdanpek	21.691	2.415	3.429
114.	Negotin	41.380	4.607	6.542
Zaječarski county				
115.	Boljevac	14.610	1.626	2.310
116.	Zaječar	63.398	7.059	10.024
117.	Knjaževac	34.345	3.453	4.903
118.	Sokobanja	17.584	3.921	5.568
Nišavski county				
119.	Grad Niš	239.596	68.656	97.492
120.	Aleksinac	55.094	15.767	22.389
121.	Gadžin Han	9.445	949	1.348
122.	Doljevac	18.645	1.874	2.661
123.	Merošina	14.244	1.432	2.033
124.	Ražanj	10.227	1.028	1.460
125.	Svrljig	16.240	1.632	2.318
Toplički county				
126.	Blace	12.995	1.306	1.855
127.	Žitorađa	17.647	3.935	5.588
128.	Kuršumlija	20.381	2.269	3.222
129.	Prokuplje	47.227	10.532	14.956
Pirotski county				
130.	Babušnica	14.222	1.429	2.030
131.	Bela Palanka	13.369	1.344	1.908
132.	Dimitrovgrad	10.964	1.220	1.733
133.	Pirot	61.578	17.623	25.024
Jablanički county				
134.	Bojnik	12.322	1.238	1.759
135.	Vlasotince	32.163	7.172	10.185
136.	Lebane	24.006	2.413	3.427
137.	Leskovac	153.084	43.811	62.211
138.	Medveđa	10.402	1.045	1.485
139.	Crna Trava	2.041	205	291
Pčinjski county				
140.	Bosilegrad	8.973	902	1.281
141.	Bujanovac	45.107	10.059	14.284
142.	Vladičin Han	22.872	2.546	3.616
143.	Vranje	87.174	24.948	35.426
144.	Preševo	38.385	8.560	12.156

145.	Surdulica	21.248	2.365	3.359
146.	Trgovište	5.837	586	833
	TOTAL	**7.443.183**	**2.374.374 t 0,87 kg/inh/day**	**3.375.000 t 1,23 kg/inh/day**

Source of data for amounts of waste in 2009: Faculty of Technical Sciences, Novi Sad: Determination of waste composition and assessment of quantities in order to define strategy for secondary raw materials management within sustainable development of Republic of Serbia, Ministry of Environment and Spatial Planning, 2008.